

TECHNICAL SPECIFICATION FOR THE MIDLIFE OVERHAUL OF 60 NEW FLYER FORTY-FOOT HYBRID BUSES

Technical Specification No. VE20-051

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**Massachusetts Bay
Transportation Authority**

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1. Overview of Bus Overhaul Work Scope

1.1 Bus Overhaul Program Overview

The Authority's New Flyer (SR1881, SR1902) XDE40 bus fleet (purchased in 2014-2015) consists of sixty (60) forty-foot, low-floor buses that have a structure comprised of mainly carbon-steel and is propelled by a diesel-electric hybrid propulsion system. The designated buses shall be overhauled/remanufactured in accordance with the requirements detailed in this Technical Specification. The Technical Specification includes several new systems and overhaul requirements. To ensure these systems are installed properly and these vehicles perform appropriately to the end of their service life, certain documentation requirements have been identified. The appropriate advanced engineering and documentation preparation is specified to ensure that the proper design approval, work procedures and quality systems have been identified and implemented by the Contractor.

To assist the Contractor in the preparation of their proposal, the Authority will provide electronic copies of the New Flyer Service and Parts Manuals upon request by prospective prime Contractors. Please note that manuals are for reference purposes only. The Authority makes no representation or warranty, either express or implied, including any implied warranty of merchantability or fitness for a particular purpose, or any other obligations or liability on the part of the Authority as to the Authority's existing vehicles, sketches, drawings, mock-ups, books, manuals, or prints. The Authority neither assumes nor authorizes any other person to assume for it any other liability in connection with the aforementioned materials. These materials should be used for reference purposes only.

Discrepancies which are identified by the Contractor shall be brought to the attention of the Authority's Technical Project Manager for discussion and appropriate resolution. Items/components identified by a specific part number or original equipment manufacturer (OEM) are the parts currently being used on the vehicle. All items/components identified in the overhaul work scope will be subject to the "Approved Equal" process if the Contractor requests an alternative source.

No more than twelve (12) buses shall be made available to the Contractor for the overhaul program by the Authority. This includes buses in transit to and from the overhaul facility.

1.2 Definitions

The following are definitions of special terms used in the Technical Specification:

Americans with Disabilities Act (ADA):

Refers to requirements of the Americans with Disabilities Act of 1990, as published in the Federal Register, 49 CFR Parts 27, 37, and 38, Transportation for Individuals with Disabilities, and as further amended.

Approved:

The Technical Project Manager concurs with the information in its submitted form. The act of approval by the Authority means that the Contractor may proceed with the design, procurement of materials, procedure, method, and/or fabrication of components/assemblies. It does not imply that the design is adequate, or dimensions are correct, and it does not relieve the Contractor of responsibility to comply with all requirements of the Specification.

Authority (or MBTA):

The Massachusetts Bay Transportation Authority is a regional transportation provider in the Boston metropolitan area created by Chapter 563, Section 18 of the Acts of 1964 of the Commonwealth of Massachusetts.

Baseline Design Configuration:

The design configuration Approved by the Authority, typically at the First Article Inspection of the Pilot bus, which defines the configuration of the serial production buses.

Bidder:

The Contractor submitting a proposal in response to the MBTA RFP for the overhaul of the New Flyer 60-foot hybrid buses.

Bus (also Coach):

A complete vehicle, that conforms to these Technical Specifications and ready to operate.

Conditionally Approved:

The Technical Project Manager conditionally agrees with the submitted information. Additional information may need to be provided to allow a complete review, or details may need to be revised for approval. A revised information package must be submitted for approval.

Contractor:

The prime Contractor is solely responsible to the Authority for the quality and proper functioning of the vehicles and all components. The person or persons, firm, partnership, corporation, or combination thereof which has entered into a procurement contract with the Authority to supply the overhauled vehicles.

Contractor's Drawings:

Items such as general arrangement drawings, detail drawings, graphs, diagrams, and sketches that are prepared by the Contractor to detail its work.

Days:

All reference to days in the Technical Specification shall be calendar days unless specifically stated.

Down Time:

The lapsed time during which equipment is not capable of doing useful work because of maladjustment, malfunction, or maintenance-in-progress.

Electronic Media:

Electronic storage device such as USB storage device or Authority approved equal.

Engineering Drawings:

A formal engineering document, fully dimensioned with tolerances, materials specifications, etc. that adequately defines a part for manufacture / assembly. Engineering Drawings must be revision controlled and formally approved by appropriate Contractor staff.

Equal:

Whenever the words "equal", "equivalent" or "approved equal" are used in connection with make or quality of material or equipment, the proposed alternative shall be functionally compatible with and of equal or better quality than the item it is proposed to replace. The Contractor must provide for Authority Approval appropriate technical documentation to verify equivalence, including a dimensioned drawing, detailed material specifications and testing documentation. The Authority's Technical Project Manager's decision as to whether any material or equipment proposed is equal to that specified shall be binding and final.

Fireproof Materials:

Materials that will not burn or melt at temperatures less than 2,000 degrees Fahrenheit (2,000 °F).

Fire-Resistant Materials:

Materials that have a flame spread index less than 150, as measured in a radiant panel flame test per current ASTM-E 162.

Fire Retardant Materials:

Materials that have a flame-spread index less than 35, as measured in a radiant panel flame test per current ASTM-E 162.

First Article Inspection (FAI):

The physical examination, functional and commercial testing and Acceptance/Approval by the Authority of an initial part, major assembly, subassembly, system, subsystem, or material manufactured or assembled by either the Contractor or Subcontractors. The FAI shall include a maintainability and quality review of the component/system.

Hardware:

Includes but is not limited to nuts, bolts, screws, rivets, fittings, clamps, washers, lock washers, insulated p-clips, seals, rollers, pins, springs, clamps, gaskets etc.

Hinge:

The term “hinge” shall be interpreted as an arrangement of retaining brackets with a flexible member or pin used to facilitate motion of one item relative to the other. Examples include but are not limited to brackets with hinge pins, brackets with hinge pins and springs, brackets with a rubber membrane in place of a hinge pin, etc. If the term “hinge” is used, unless otherwise specified, it shall include all hardware securing the hinge in place.

Hose (also line or tube):

The term “hose” shall be interpreted as any flexible vessel used to transport lubricant, fuel, air, or any other fluid from one part of the vehicle to another. This shall be interpreted as including all flexible “lines” and “tubes”, regardless of material (rubber, plastic, braided steel, etc.). Pipes, which are hard plumbed, are not included in this definition (See also “Pipe”).

Latch:

When used, the term “latch” shall include the latch itself, the latch striker (if applicable), and all hardware used to secure the latch and striker.

Maintenance Manual(s):

Detailed instructions for servicing and maintaining the bus, electrical prints, pneumatic diagrams and hydraulic diagrams. All manuals shall be provided in both the electronic and hard copy formats.

Mean Mileage Between Failures (MMBF):

The mean operating mileage between independent failures.

New:

New, unused OEM part that meets or exceeds OEM specifications. The burden of providing documented proof that parts meet or exceed OEM specifications will be on the Contractor.

New System:

Any system that is specified to be incorporated into the New Flyer 40-foot hybrid bus fleet, as outlined in these technical specifications, which was not incorporated in the buses when they arrived at the Contractor’s facility.

Not Approved:

The Technical Project Manager does not concur with the submitted details. The submittal shall be modified and resubmitted in its amended form.

Original Equipment Manufacturer (OEM):

Original manufacturer of a specific part, component, or system. The bus body and system integration were

originally designed by New Flyer; however, most subsystems/ components were provided by original equipment manufacturers and designed to operate/ perform to specific standards. In instances where OEM components are identified in the Technical Specification, it is because other suppliers will not be able to provide reliable operation and/or perform to the Authority's standards.

Overhauled (also remanufactured):

Remanufactured/rebuilt in accordance with an approved procedure as outlined in the Technical Specifications. If not specifically stated, all equipment requiring overhaul shall be remanufactured in accordance with approved original OEM or supplier specifications.

Pilot Bus:

The first overhauled bus to be presented to the Authority for review of the final baseline design configuration. The Contractor shall develop design review submittals, work procedures, and other documentation for overall design. The Pilot Bus shall establish a template for a consistent overhaul of subsequent buses.

Pipe:

Any rigid tubing, piping, or ducting which is hard plumbed in place shall be considered "pipe" and is not to be confused with hose, tube, etc. Examples of pipe are: copper tubing, and exhaust ducting / piping.

Proof (used as a suffix):

Component, subsystem, assembly, or part is designated as "splash-proof," "dustproof," etc., when so constructed, protected, or treated that its successful operation is not interfered with when subjected to the specified material or condition.

Rebuild:

To restore an item to OEM specifications by replacing all wear items of a component including cleaning, adjusting, lubricating and painting according to the OEM's recommendations and specifications using OEM parts.

Reliability:

The probability of a bus or bus component performing a specified function without failure and within design parameters for a specified period of time or distance, under actual operating conditions.

Remanufactured:

A component that is remanufactured to the original specifications and drawings and verified through testing to meet or exceed OEM specifications. The burden of providing documented proof that parts meet or exceed OEM specifications will be on the Contractor.

Repair:

To restore an item to OEM specifications by performing all work necessary to fix any non- functioning or failing part or component according to the OEM's recommendations and specifications

Resident Inspector or Inspector:

The person or firm designated by the Authority as its quality assurance representative(s). A representative(s) of the Authority assigned to verify Contractor compliance to the baseline design work scope, verify materials used, and inspect workmanship. The Resident Inspector shall confirm all extra work (hidden damage), witness tests and approve all buses prior to shipment from the Contractor's production facility.

Safe:

The condition in which passengers, operators, or maintenance personnel are secure from threat or danger, harm, or loss arising from improper design, manufacture, assembly, malfunction, or failure of the bus or any of its components or systems.

Self-Extinguishing:

Materials in which flame propagation is limited to 4.0 inches when tested in accordance to FMVSS 302.

Significant (Repairs):

Any repair that will exceed 75% of the cost to replace with new and is at the discretion of the Authority.

Standard Configuration Bus:

The 40-foot bus described in this Technical Specification.

Standards:

Standards referenced in these Technical Specifications are the latest revisions unless otherwise stated.

Special Listings:

Technical Documentation regarding the Operation and Maintenance of a vehicle or the vehicle subcomponents which is not provided as part of the OEM or OEM vendor Service and Parts Manuals.

Stainless Steel:

All new stainless-steel materials used on the vehicles, not limited to hinges, fasteners, etc., shall be grade 304 stainless-steel or Approved Equal.

Structure:

The bus body, including floor deck material and installation, load bearing external panels, structural components, axle mounting provisions, and suspension beams and attachment points.

Subcontractor:

An individual, firm, partnership, corporation, or joint venture to whom the Contractor sublets any part, subsystem, component or hardware for the Contract.

Supplier (or Sub-supplier):

Person(s), firm, partnership, corporation or combination thereof who builds, produces services, or supplies materials, equipment or apparatus for installation on the vehicle. Supplier- furnished materials or services shall comply with all contract requirements.

Tamperproof:

Fasteners are designated as tamperproof when they are selected so that they cannot be easily loosened by hand or with common tools such as a flat blade or cross-recessed head screwdriver or pliers. All new tamperproof fasteners used shall be of OEM design or Authority approved equal.

Technical Project Manager:

The person designated by the Authority to be its liaison with the Contractor on all technical matters pertaining to the work. The Technical Project Manager is empowered to act on behalf of the Authority in such matters as acceptance of Contractor's drawings, test procedures, First Article approvals, and bus acceptance. The Technical Project Manager is responsible for technical issues on behalf of the Authority and shall be designated as such on official MBTA letterhead.

Tight (used as a suffix):

Apparatus is designated as "watertight," "dust-tight," etc., when so constructed that the enclosing case will exclude the specified material.

1.3 Abbreviations

The following is a list of abbreviations used in the Technical Specifications:

ACTM:	AC Traction Motor
AVL:	Automated Vehicle Location
°F:	Degrees Fahrenheit
°C:	Degrees Celsius
CAD:	Computer Aided Dispatch
CDR:	Contract Deliverables Requirements
CFM:	Cubic Feet Per Minute
DC:	Direct Current
DOC:	Diesel Oxidation Catalyst
DPF:	Diesel Particulate Filter
DPIM:	Dual Power Inverter Module
EMI:	Electromagnetic Interference
ESS:	Energy Storage System
FPM:	Feet Per Minute
FPSPS:	Feet Per Second Per Second
FRP:	Fiber reinforced plastic
GPS:	Global Positioning System
GVWR:	Gross Vehicle Weight Rating
HCFC:	Hydrochlorofluorocarbon
HP:	Horsepower
HVAC:	Heating Ventilation and Air Conditioning
Hz:	Hertz
ITS:	Instruction to Service
kHz:	Kilohertz
LED:	Light Emitting Diode
lbs.:	Pounds
mA:	milli-ampere
MBTA:	Massachusetts Bay Transportation Authority
MHz:	Megahertz
MPH:	Miles Per Hour
MPHPS:	Miles Per Hour Per Second
MMBF:	Mean Miles Between Failures
MTTR:	Mean Time to Repair
NTP:	Notice to Proceed
OEM:	Original Equipment Manufacturer
PA:	Passenger Announcements
PLC:	Programmable Logic Controller
PSI:	Pounds Per Square Inch
PSIG:	Pounds Per Square Inch, Gauge
RFI:	Radio Frequency Interference
RPM:	Revolutions Per Minute
SLW:	Seated Load Weight
ULSD:	Ultra Low Sulfur Diesel
VMS:	Vehicle Messaging System

1.4 Acronyms, Standards and Codes

The following is a list of acronyms, standards and codes used in the Technical Specification. All standards and codes that are specified in these Technical Specifications are the latest revisions unless otherwise noted. The latest revision in effect for each standard at the time of Notice to Proceed (NTP) shall be used in conjunction with the Technical Specifications. The Contractor shall be responsible for obtaining all applicable standards and for supplying copies to all subcontractors/sub suppliers. If the Contractor proposes to use a substitute standard (i.e., international standard), the Contractor is required to provide proof-of-equivalency for the Authority's review and

approval for each substituted standard. The following is a list of standards and codes that must be met, whether or not they are specifically referenced in these Technical Specifications.

ADA:	Americans with Disabilities Act
ANSI:	American National Standards Institute
APA:	American Plywood Association
APTA:	American Public Transit Association
ASHRAE:	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASCII:	American Standard Code for Information Interchange
ASME:	American Society of Mechanical Engineers
ASTM:	American Society for Testing and Materials
ATA:	Air Transport Association of America
AWG:	American Wire Gauge
AWS:	American Welding Society
BMCS:	Bureau of Motor Carrier Safety
CFR:	Code of Federal Regulations
DOT:	United States Department of Transportation
DPU:	Massachusetts Department of Public Utilities
EIA:	Electronic Industries Association
EPA:	Environmental Protection Agency
FCC:	Federal Communications Commission
FMCSR:	Federal Motor Carrier Safety Regulations
FMVSS:	Federal Motor Vehicle Safety Standards
FTA:	Federal Transit Administration (formerly UMTA), agency within the DOT
IEEE:	Institute of Electrical and Electronics Engineers
ISO:	International Standards Organization
JIC:	Joint Industrial Council
MIL:	Military Specification
NEC:	National Electrical Code
NEMA:	National Electrical Manufacturers' Association
NFPA:	National Fire Protection Association
NHTSA:	National Highway Traffic Safety Administration
PCMCIA:	Personal Computer Memory Card International Association
PTI:	Pennsylvania Testing Institute at Altoona, PA
SAE:	Society of Automotive Engineers
SPI:	Society of the Plastics Industry
UL:	Underwriters Laboratories Incorporated
USDOT:	United States Department of Transportation

1.5 General Requirements

1.5.1 Accessibility / Maintainability

All new systems or components installed on the bus requiring service as part of periodic maintenance/service, repair and replacement and inspection shall be readily accessible and must be capable of being performed within one half hour. To the extent practical, removal or physical movement of components unrelated to the specific maintenance and/or repair tasks involved shall be unnecessary.

Relative accessibility of components, measured in time required to gain access, shall be inversely proportional to frequency of maintenance and repair of the components. Accessibility / Maintainability shall be considered by the Contractor throughout the design process and will be significant criteria used by the Authority when evaluating / approving Contractor proposals.

1.5.2 Interchangeability

Components with identical function shall be interchangeable to the extent practical. These components shall include passenger window hardware, interior trim, lamps, lamp lenses, and seat assemblies. Components with non-identical functions shall not be, or appear to be, interchangeable.

1.5.3 Vibration

The “New Systems” shall have components (electrical, mechanical, and other connections) designed to operate without degradation during and after exposure to vibration as encountered in normal service. Mechanical components shall be mounted to minimize transfer of vibrations to passengers.

1.5.4 Operating Environment Requirements

The “New Systems” shall be capable of being operated at the specified performance levels and stored and maintained without impairment resulting from the natural or induced environmental conditions within which the Authority intends to operate the bus in revenue service.

The following climatic factors shall be used as design guidelines and shall be considered as operational requirements.

- a) Temperature and Solar Load:
Ambient air temperature:
Minimum - 20°F
Maximum 120°F
- b) Humidity:
Minimum 5%
Maximum 100%
- c) Precipitation:
Maximum rainfall rate 4 inches per hour
Maximum snowfall rate 5 inches per hour
Maximum snow accumulation 18 inches
- d) Wind:
Maximum sustained speed 60 mph
Maximum gust speed 70 mph
- e) Air contamination: The vehicle shall operate as specified under air contamination levels which occur in the coastal environment that exists in the Authority’s service area.
- f) Road contamination: The vehicle shall operate as specified under the dust, trash, and leaf accumulation conditions experienced in the Authority’s service area. Salt and other chemicals are frequently applied to streets during adverse winter weather conditions.

The bus shall achieve normal operation in temperature ranges of -20°F to 115°F, at relative humidity between 5 percent and 100 percent. Degradation of performance due to atmospheric conditions shall be minimized at temperatures below -20°F or above 120°F.

Actual localized temperatures and conditions within and under the bus body may be more severe than those listed. The Contractor shall be responsible for evaluating and advising the Authority if there are any special environmental factors to which its equipment may be sensitive, and that are not listed in this section.

1.6 Service Proven Materials and Equipment

The Authority is willing to take advantage of new technologies when practical and risks are low. The Bidder shall demonstrate the benefit of using any new materials and technology being proposed and provide assurances that the Authority will not end up with a problematic design. The Authority requires that all buses; bus systems and component designs shall be service-proven. A service-proven design shall meet all the following criteria:

- Used in revenue service for at least 3 years.
- Used in revenue operation for at least 5,000,000 miles with at least 100,000 miles per bus.
- Used on a minimum fleet size of 50 buses.
- Has achieved a MMBF consistent with the Authority's goal of 20,000 miles.
- Demonstrated as reliable with appropriate Quality service history that includes documentation reflecting performance in previous applications. The Authority will make all appropriate determinations regarding acceptable service history.

1.7 MBTA Safety and Regulatory Requirements

The Contractor shall incorporate appropriate Safety Certification functions, processes and activities to ensure that all hazards have been effectively identified, analyzed, and eliminated or mitigated to the lowest practical level of risk. Design, changes or modifications that may impact safety shall be defined, appropriately documented, and submitted to the Authority for review and approval.

The Contractor shall provide general workshop and safety requirements to the Authority for review and approval as part of the design review process. [CDR #7]

In addition, the Contractor shall comply with all MBTA Safety Certifications and regulatory requirements in effect at the time the NTP is issued as defined within the Contract documents. The Contractor shall collaborate with MBTA to ensure that safety concerns and hazards have been effectively addressed, eliminated, or mitigated to the lowest practical level of risk.

Additional safety and regulatory requirements may be listed throughout the Technical Specifications.

1.7.1 Fire Safety Requirements

The bus shall be remanufactured, utilizing equipment and materials which meet all applicable fire safety and smoke emissions regulations.

All new or replacement materials used in the overhaul of the passenger compartment of the bus shall be in accordance with the Recommended Fire Safety Practices defined in FTA Docket 90-A, dated October 20, 1993. Materials entirely enclosed from the passenger compartment need not comply, unless otherwise specified. In addition, smaller components and items, such as switch knobs and small light lenses, shall be exempt from this requirement. The contractor shall identify and submit for review at the initial design meeting, the smoke and flammability characteristics certification for all new or replacement material used in the passenger compartment.

1.7.2 Electrical Safety Requirements

The Hybrid Drive system uses potentially hazardous electrical energy. The Contractor shall be required to provide appropriate safety training and required safety equipment to all personnel, including subcontractors, working near or on the high voltage system. The Contractor's training shall include arc-flash training, NFPA 70E or OSHA training per 29 CFR 1910, and related OEM servicing and maintenance training for high voltage systems. Electrical safety procedures shall be included in the Safety Practices and General Workshop Procedures Submittal for review as part of the design review process.

1.8 Material Handling and Disposal Requirements

As used in this provision: (a) “hazardous materials” shall mean any substances present in quantities and in forms which require investigation, removal, cleanup, transportation, disposal, response or remedial action (as the terms “response” and “remedial action” are defined in Section 101 of the Comprehensive Environmental Compensation and Liability Act of 1980, as amended, 42 U.S.C. §9601 (23) and (24)) under any applicable federal, state or local environmental law, regulation, ordinance, rule or bylaw, as such are amended from time to time, whether existing as of the date hereof, previously enforced or subsequently amended; and (b) “release” shall mean any releasing, spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, disposing or dumping. The Contractor shall comply with all relevant federal, state, and local statutes, rules, regulations and ordinances pertaining to such work. The Contractor shall take all necessary precautions to protect the Contractor’s personnel, the Authority’s personnel, and the public from exposure to hazardous materials.

1.9 Materials and Workmanship

Upon request of the Authority the Contractor shall submit samples of materials for examination, tests, and concurrence. All samples requested in this Specification, to be sent to the Authority, shall be delivered F.O.B. destination as designated by the Authority.

All parts used by the Contractor in the remanufacturing process shall be new unless specifically approved by the Authority. In no case shall obsolete or discontinued parts be used. Repairs or corrective actions to parts and components supplied under this Technical Specification shall be agreed upon in advance by the Authority. The remanufactured buses may incorporate product improvements and upgrades with Authority approval.

The following requirements apply to all new equipment/systems, the remanufacturing of existing bus equipment, as well as the installation/application of materials and equipment to the buses by the Contractor. All piping, pumps, tubing, cables, and wiring shall be properly bracketed. All pass-through holes for piping, tubing, cables, and wires shall be free of sharp and rough edges (for both existing or new pass-throughs). Grommets, solid sleeve P-clamps and/or other means of protection shall be used to prevent damage, over the life of the buses. To the maximum extent possible all piping, tubing and cables located underneath the bus shall have provisions to protect the systems from road debris, salt and sand via a protective plate or other suitable means. Final approval of the protective provisions will be provided by the Authority during the First Article Inspection.

All mounting of assemblies and subassemblies including the power plant and accessories shall be mechanically isolated to minimize the transmission of vibration of the body structure.

All pipe fittings shall be of heavy-duty type and shall be designed to withstand the maximum pressure that could be generated under normal or overload conditions, within the air or fluid system of which they are a component.

All coolant and water lines routed through the interior of the bus will be done in a method that prevents leaks into the interior of the bus. Provisions shall be made to retain all fluid leaks, which have the potential of entering the passenger and driver’s area of the bus in a manner as approved by the Authority.

All hose clamps shall be stainless steel and shall meet the requirements of SAE J1508_200903 for the type of hose and system where it will be installed.

All burrs and sharp edges shall be appropriately dressed (e.g. grommets, deburring) to prevent damage to other vehicle components (e.g. wiring) and/or injury to passengers, operators, and maintenance personnel. All clevises shall be removable.

All painted aluminum sheets shall be thoroughly cleaned and coated on the outside with zinc-chromate protective paint, or approved equal, prior to installation on the bus. All aluminum surfaces not otherwise protected and installed in areas subject to corrosion shall be anodized. Anodizing specifications shall require concurrence of the Authority.

Wood of any type shall not be used except where specified herein and approved by the Authority.

All welding performed on the structure shall conform to AWS standards for quality and fitness for purpose. Welding procedures, welding materials, and qualifications of welding operators and inspectors shall be in accordance with AWS and ASTM standards. Welds shall have a finished appearance where visible. For all welded connections, the contact surfaces shall be free of scale, grease, and paint. The Contractor shall provide for review documentation of their welding processes, set up sheets and procedures to the Authority at the Initial Design Review Meeting, for production inspection purposes. **[CDR #10]**

The Contractor shall not perform any welding on Authority buses until the above documentation has been submitted and approved.

All surfaces to which springs are attached shall be of such a pattern as to prevent excessive grooving or wear of the parts.

All joints shall be protected by application of zinc-chromate metallic compound, butyl tape sealer, or approved equal, at assembly. All bolts, nuts, washers and exposed linkage shall be zinc- or cadmium-plated carbon steel, or carbon steel, except where specified. Zinc plating shall conform to the latest revision of ASTM-B-633, Type II, SC3 or SC4. Cadmium plating shall conform to the latest revision of SAE-AMS-QQ-P-416, Class 2 or 3, Type II.

All bolted connections shall be designed to a minimum strength value of SAE Grade 8 or metric equivalent nuts and bolts using a minimum design margin of 1.5 based on proof load of the bolt. Bolts and nuts shall be SAE Grade 5 or better and marked according to SAE Standards J429 and J995 or metric equivalent. Any deviations from this standard will require Authority approval during Design Review.

Bolt projections through nuts shall exceed 1-½ threads and shall not exceed thickness of a standard nut. Should there be a reason for excessive bolt projection, the bolts shall be double nutted.

All sheet metal screws shall comply with ASTM and SAE recommendations relative to quality and installation. Phillips headed fasteners, self-tapping and sheet metal screws, blind rivets and rivnut-type fasteners shall not be used without prior approval of the Authority for each specific application.

Specific manufacturer's recommendations as to the adjustment and settings of components shall be provided to the Authority before delivery of the first bus. Items such as air spring heights, voltage regulator, governors, engine tune-up data and any other pertinent data shall be furnished to allow time to prepare service and inspection forms for initial bus inspection.

Fiber reinforced components shall not have sections that are fiber or matrix rich, or fiber or matrix poor. Plastic components shall not have resin rich, or resin poor sections. New fiber reinforced components installed on any vehicle shall be Resin Transfer Molded using appropriate reinforcement techniques / materials. All fiber and matrix materials used in the buses shall require prior approval by the Authority at the initial design review meeting. "Spray up" fiberglass shall not be used.

All air, oil, HVAC, and water lines and openings into equipment units shall be sealed, plugged, or adequately protected against entrance of contaminants until connected.

Mounting of major assemblies including engine, ACTM, axles, power steering and suspension components shall be such that dismounting shall be easily carried out by conventional shop methods.

Drainage shall be provided in all body structure members. Enclosed structural cavities shall be vented to prevent condensation build up. Any enclosed structural cavities of steel members shall be treated with a rust-inhibiting coating.

1.10 Torque

All fasteners shall be torqued in line with OEM specifications. As part of the Design Review process, the Contractor shall develop a torquing procedure(s) for Authority review and approval. **[DRS #1]**

The Contractor shall provide torque procedure(s), which shall identify torque values for all fasteners, including an appropriate tolerance in line with manufacturer's recommendations and/or industry standards, and a list of all Safety Critical fastener locations and all high voltage connections. Torque of Safety Critical and high voltage fasteners must be witnessed and verified by the Resident Inspector and the Contractor's Quality Assurance personnel.

All suspension component fasteners, wheel nuts, steering system fasteners, and other fasteners as appropriate or as required by the Authority shall be torque striped to verify proper torque values have been applied. Safety Critical torque locations shall be torque striped by both the installer and (using a different color) the Contractor's Quality Assurance representative who witnesses the torquing.

1.11 Fluids and Lubricants

The following is a list of Massachusetts Bay Transit Authority (MBTA) required fluids for the MBTA New Flyer XDE40 buses. Any fluids the Contractor proposes to use that are not on this list must be presented to the Authority for review and approval. The Contractor shall submit a listing of all fluids and lubricants proposed to be used during the design review process and prior to use on any bus. **[DRS #2]**

<u>Fluid</u>	<u>Description</u>	<u>Manufacturer</u>
Diesel Engine Oil	Shell Rimula Super 15W40 - (Cummins Engineering Standard (CES) 20086 latest revision) API Class CK-4	Shell
Traction Motor (ACTM) Fluid	TranSynd 295	BP
Synthetic Differential Oil	Delvac Synthetic Gear Oil (75W-90)	Mobil
Anti-Freeze	Fleet Charge 50/50	Old World Industries
Power Steering Fluid	Kendal Versa – Tran ATF (Factory Fill – DEXRON®-III)	Conoco Phillips
Grease	Lithium Complex Hi Temp EP 2	
Diesel Exhaust Fluid (DEF)	API Certified Stabilized Urea Premix, meeting ISO 22241-1 standard, Cummins Service Bulletin 4021566	
Wheelchair Ramp Hydraulic Oil	DEXRON®-III	
Entrance and Exit Door Baseplate Spherical Bearing	SAE 20	
Brake Treadle and Foot Valve Assembly	Barium Grease per BW-204-M	Bendix #246671

Table 1: Fluids List

Fluids and/or lubricants with no “Manufacturer” are considered generic. However, supplier/manufacturer information still shall be presented to the Authority for review and approval.

Please review the New Flyer service/maintenance manuals for additional information.

All grease / lubrication fittings shall be replaced with new. New fittings shall be appropriately masked during production in order to keep them free from paint and undercoating. Fittings shall be located and positioned to be conveniently reached from a pit and/or hoist. All grease / lubrication fittings shall be of the threaded type and shall not require special adapters.

All lubricant sumps shall be fitted with magnetic- type drain plugs.

1.12 Guards

Piping, pumps, wiring, control rods, and equipment located within the bus shall be adequately protected against damage or interference by, or hazard to, passengers or the operator. Inclusive of this requirement shall be fluids and other related materials.

When a shield or guard is placed around a unit requiring inspection and/or lubrication, the shield shall be so secured as to provide for easy access to the unit.

All electronic and electrical systems shall function properly without degradation from electromagnetic sources and without degrading the electromagnetic environment. All electronic and electrical systems shall not be susceptible to temporary or permanent malfunctions subject to electromagnetic sources, either transient or steady state in nature. Electromagnetic interference arising from sources such as transmitters or other equipment located either on-board or adjacent to the bus or from component parts of the bus's ignition or electrical power supply system shall not degrade the operating life expectancy of the on-board electronic equipment.

1.13 Resident Inspector

The Authority shall be represented at the Contractor's plant by Resident Inspector(s), who shall monitor the re-manufacturing of the transit buses. The Resident Inspectors are authorized to approve the pre-delivery acceptance tests and required to sign for the release of a bus for delivery, unless MBTA Technical Project Manager approves an exception. The presence of these Resident Inspectors in the plant shall not relieve the Contractor of its responsibility to meet all of the requirements of this procurement. Upon request to the quality assurance supervisors, the Resident Inspectors shall have access to the Contractor's quality assurance files related to this procurement. These files shall include but not be limited to drawings, assembly procedures, material standards, parts lists, inspection processing and reports, and records of defects.

The initial arrival of the Resident Inspector at the Contractor's facility shall be at the discretion of the Authority. In order to maximize the effectiveness of the Resident Inspector's time, certain milestones should be completed prior to the Inspector's arrival. These requirements shall be coordinated with the Contractor during the initial project meetings. During the initial teardown phase of the project and/or at other parts of the project, the Authority may substitute alternate personnel for the Resident Inspector at their discretion.

The Contractor shall provide appropriate office space for the Resident Inspectors in close proximity to the final assembly area. This office space shall be equipped with desks, outside and interplant telephones, copier and facsimile machine, file cabinet, chairs, internet access, and clothing lockers sufficient to accommodate the Resident Inspector. The office shall be appropriately heated in the winter and air conditioned in the summer. The Resident Inspector shall have access to restroom facilities. The Resident Inspector shall have direct 24 hour, 7-day access to his office by automobile.

2. Design Review Process

2.1 Overview

To effectively demonstrate the proposed scope of work being performed by the Contractor, the Authority has established a Design Review Process to understand the Contractor's approach and work procedures that will be utilized on the Pilot Bus and serial production buses.

The Design Review process defined herein includes four stages, which consists of an Initial Design Review, Structural Teardown Inspection, Intermediate Design Review, and a Final Design Review. At each of these stages, the Contractor shall provide sufficient information to define the proposed remanufacturing processes and procedures, present qualifications for proposed subcontractors and present design proposals for the new systems specified. All materials to be reviewed at each design review meeting must be provided to the Authority for review a minimum of three (3) working days prior to the meeting. The process shall result in the production of a Pilot Bus, which will undergo a First Article Inspection (FAI) to ensure full compliance to the Technical Specification, drawings and Authority Approvals. The Approved Pilot Bus design will serve as the "Baseline Design Configuration" for production.

Any deviations from this specification or its attachments, including but not limited to proposed improvements, enhancements, or cost savings initiatives shall be presented to the Authority through the Design Review Process.

2.2 Design Review Submittals (DRS)

All new and improved items, "approved equals", and any other, systems, parts, or procedures identified by the Authority shall be presented by the Contractor to the Authority for review and approval through the Design Review Process. Each design review item shall be provided to the Authority for review and approval as a Design Review Submittal (DRS). [CDR #14]

At a minimum, the Contractor shall provide the Authority with a complete engineering drawing package and assembly / installation work procedures. Work procedures should include, but are not limited to, listing of all materials used (including bus and component manufacturer OEM part numbers), special tools and equipment used, and step-by-step instructions of the work to be performed by the Contractor. Work procedures may reference/utilize information already available from vendors, maintenance manuals, and other sources when applicable. Where appropriate or as required by the Authority, the Contractor shall provide supplementary information including but not limited to materials specifications, operator certifications / qualifications, testing data, etc.

Deviations from the Technical Specification and attachments, including but not limited to proposed improvements, enhancements, or cost savings initiatives shall be submitted to the Authority as an additional Design Review Submittal and should be listed in the DRS schedule. The DRS schedule shall be provided to the Authority at the Kickoff Meeting. [CDR #5b]

Design Reviews shall be conducted on the items / systems listed below in the table below (additional Design Review Submittals may be added at the Authority's discretion):

DRS #	Description	Spec. Reference
1	Critical Torque Procedures	1.10
2	Fluids and Lubricants	1.11
3	Front Axle, Suspension, and Brakes	3.1
4	Rear Axle, Suspension, and Brakes	3.2
5	Steering	3.6
6	Engine	3.7
7	Fire Suppression System	3.8
8	Hybrid Drive System (including ESS, APS, PCS, ISG, ACTM, and PSR)	3.9
9	Cooling Systems	3.10
10	Fuel System	3.11
11	Air System	3.12
12	Electrical System	3.13
13	HVAC System	3.14
14	Structural Repairs	3.15.1
15	Corrosion Protection/Undercoating	3.15.2
16	Interior	3.16
17	Exterior	3.17
18	Windows and Windshields	3.18
19	Access Doors & Panels	3.19
20	Entrance & Exit Doors	3.20
21	Passenger Seating & Stanchions	3.21
22	Destination Signs and Other Out of Scope Equipment	3.22
23	Driver's Area	3.23
24	Wheelchair Ramp	3.24
25+	Optional Work Scope	3.25 & TS Attachments

Table 2: Design Review Submittals

Any further design changes or improvements presented by the Contractor or Authority shall be submitted to the Authority for review.

2.3 Design Review Meetings

2.3.1 Kickoff Meeting

The Authority will conduct a line-by-line review of the Contract Terms & Conditions and Technical Specification to ensure the Contractor has a clear understanding on the Authority's expectations of the work scope and Contract Requirements. The Contractor shall be prepared to present any and all items critical to design, delivery, testing, acceptance, and overall contractual performance. This includes any potential approved equals being considered by the Contractor.

Project kick-off meeting will be held within two (2) weeks of NTP at a MBTA facility.

The Contractor will be required to provide project schedule [CDR #1], production schedule [CDR #2], and test schedules [CDR #5c] at the Kickoff Meeting.

A Contract Deliverable Requirement (CDR) and Design Review Submittals (DRS) schedule, will also be required, with estimated completion dates for all items.

In addition, the Contractor shall provide a Pilot Bus Program Plan and Structural Inspection Plan. The Kickoff Meeting will be held at a location in Boston to be determined by the Authority.

2.3.2 Initial Design Review (and Structural Teardown Inspection) Meeting

The Initial Design Review Meeting shall occur within eight (8) weeks of NTP. This meeting is for the Authority and Contractor to review the three (3) torn down buses (Pilot Bus and two (2) production buses), as well as for the Contractor to present to the Authority the “Pilot Bus Structural Inspection Teardown Report” and “Serial Production Inspection Procedure” [Reference Section 2.4 for further details]. During this time, the Project Team and Contractor will work toward resolving any critical design concept issues particularly where prior approval is required.

The Contractor shall review the progress/status of the CDR and DRS schedules. The Initial Design Review Meeting will be held at the Contractor’s location.

2.3.3 Intermediate Design Review Meeting

The objective of the Intermediate Design Review shall be for the Contractor to present the outstanding design details of the overhaul program for the Authority’s review and approval. The Contractor shall review the progress/status of the CDR, and all tasks identified on the DRS schedule.

The Contractor shall be prepared to present any and all items critical to design, delivery, testing, acceptance, and overall contractual performance that were not resolved at the Initial Design Review Meeting.

During this meeting, any open issues as a result of the documentation submitted to the Authority shall be discussed along with any new submittals such as, but not limited to design, schedule and documentation issues.

The Intermediate Design Review will be held within 12 weeks from NTP at the Contractor’s facility.

2.3.4 Final Design Review

The Final Design Review Meeting shall occur within sixteen (16) weeks of NTP. A final review of all remaining open design drawings, required analysis, Authority Approvals, Contract Deliverable, Requirements, and Design Review Submittals shall be conducted. Items closed during earlier reviews need not be addressed again. The objective of the review is to freeze the design of the Pilot Bus. At the conclusion of this meeting the Authority and the Contractor must have a clear understanding and agreement on the configuration of the Pilot Bus to be inspected at the Pilot Bus First Article Inspection.

The Final Design Review will be held at the Contractor's location.

2.3.5 Additional Meetings

If the Authority or Contractor require additional meetings, all respective parties must be notified at least two (2) weeks prior to the proposed meeting. The location of these meetings will be at the discretion of the MBTA.

2.4 Serial Production Structural Inspection Procedure

Based on the findings of the “Pilot Bus Structural Teardown Report”, a detailed “Serial Production Structural Inspection Procedure” shall be developed by the Contractor for the balance of the fleet. This plan shall outline the Contractor’s approach to the teardown, inspection and repair processes for all serial production buses. The Serial Production Structural Inspection Procedure shall be submitted to the Authority two (2) weeks after the Initial Design Review Meeting by the Contractor. [CDR#11]

All inspection findings on all buses shall be presented to the Authority, and complete structural inspection records for each bus shall be included in the respective bus’s Coach History Book.

As subsequent buses are inspected, and additional defects are discovered, the inspection and repair of these newly identified defects shall be incorporated into a revised procedure as appropriate.

2.4.1 General Requirements for Each Meeting

The agenda for each meeting shall be submitted by the Contractor to the Authority at least three (3) working days prior to the meeting date.

All materials to be reviewed at the Design Review meetings must be provided to the Authority for review a minimum of three (3) working days prior to the meeting.

Project, CDR, and Design Review Item schedule compliance and current status shall be reviewed during each meeting.

The Authority will keep detailed minutes of all meetings, including but not limited to the following information:

- Date, time and location
- Attendees, including titles and affiliations
- Subjects discussed, and agreements reached
- Drawings and sketches submitted for review and action taken

A copy of the minutes of each meeting shall be prepared and delivered within the time stipulated at the close of the meeting and/or as directed by the Authority's designee present at same.

The draft minutes shall be reviewed for any corrections, if necessary, by the Authority, after which three final copies shall be prepared and signed by the Authority and the Contractor, with each party retaining one copy.

2.5 Pilot Bus Program Plan

The Contractor shall provide a written Pilot Bus Program Plan which clearly defines the Contractor's approach to the structural teardown, reassembly, testing, and complete overhaul as well as identification of all potential roadblocks and other critical issues. The Contractor shall include Contract Deliverable Requirements, Design Review Items, and Test schedules in the Pilot Bus Program Plan, as well as reference other items that require Authority Approval. The plan shall be submitted to the MBTA at the Kickoff Meeting. [CDR #3]

Updated versions of the Pilot Bus Program Plan shall be submitted during Design Reviews as the design progresses. The Contractor's plan shall outline a comprehensive schedule for these activities, including the identification of the critical path and high-risk areas. The objective of the Pilot Bus Program Plan is to ensure that an acceptable design configuration and vehicle performance is achieved and to lessen the probability of costly and inconvenient retrofits. The Contractor may proceed at risk to start serial production prior to the Pilot Bus FAI review and approval.

2.6 Pilot Bus Structural Inspection Plan and Teardown Report

The vehicle chassis and structure is comprised of primarily carbon steel with some areas made from ferritic stainless-steel to resist corrosion. Contractor shall thoroughly inspect the structure of all buses, to identify structural issues so that they can be corrected. Refer to Sections 1.9 and 3.15 for structural and welding repair requirements.

The Contractor is required to provide a detailed "Pilot Bus Inspection Plan" for the Pilot Bus and two additional buses as part of the design review process. The structural inspection of the Pilot Bus and two additional buses shall be comprehensive in scope and shall be used to establish appropriate inspection protocols for the balance of the fleet. This "Pilot Bus Inspection Plan" shall describe how the Contractor will clean and inspect the structure for cracks, corrosion, damage and water/condensation build up, in areas including but not limited to:

- All window and door corners (top and bottom) and headers
- All suspension mounts (for shock absorbers, suspension rods, and air bags), and nearby support framing
- Underframe structure under and near all doorways
- Engine compartment and HVAC area structure
- Equipment mounting frames and mounts
- Interior ventilation ducts/overhead lighting compartments
- Roof seams
- Front tow eyes and all bumper mounts
- Damage due to accidents or aggressive towing/lifting.
- Remove streetside and curbside side panels (up to the bottom of the window frame and all panels after the rearmost windows)

The Contractor shall be responsible for the reinstallation of all removed components required to conduct the Structural Teardown and Inspection on the pilot bus and two (2) buses (first three buses).

The structural inspection of the first three buses shall follow the plan described above and will include visual and nondestructive inspection methods. It shall include thickness checks, using ultrasonic testing, of all structural areas with visible corrosion. Interior panels do not require removal unless determined necessary by the Authority due to exterior panels showing signs of damage, rust/moisture trails, or other indications. The Pilot Bus Structural Inspection Plan shall be submitted to the Authority for review and approval at the Kickoff Meeting. **[CDR#4]**

The Contractor shall follow the “Pilot Bus Structural Inspection Plan” and based upon the documented findings, prepare a detailed “Pilot Bus Structural Teardown Report” on the Pilot Bus and two additional buses. This report shall provide detailed descriptions and photographic documentation of all damage found, with an emphasis on that damage which had not been previously identified or anticipated. The report shall also identify standard repair procedures (if any) that are recommended to be implemented fleetwide on all buses. The Pilot Bus Structural Teardown Report shall be submitted to the Authority two (2) weeks after the Initial Design Review Meeting. **[CDR #11]**

Repairs identified through the structural inspection shall be presented to the Resident Inspector for Hidden Damage repair consideration.

2.7 Contract Deliverable Requirements (CDR)

Included herein is a listing of items identified within this Technical Specification which must be prepared and delivered by the Contractor and approved by the Authority during the Design Review Process. This listing is provided solely for the convenience of the Contractor and does not purport to be complete. This listing remains subject to modification by the Authority and/or Contractor during contract execution if needed.

Required CDR items must be completed and at a minimum receive Conditional Approval from the Authority prior to the Pilot Bus FAI. Final approval of documentation must be completed prior to the delivery of the first serial production bus.

The Contractor bears the responsibility for submitting a complete and comprehensive Contract Deliverable Requirements (CDR) table at the kick-off meeting for the Authority’s review and approval. **[CDR #5a]**

The CDR table shall include the following:

- A) Item Number
- B) Title of CDR
- C) Description of CDR
- D) Contract / Technical Specification Reference

- E)** Reason for Submittal (information or approval)
- F)** Required Submittal Date
- G)** Actual Submittal Date
- H)** Current Status and Any Other Pertinent Information.

Following Design Review Submittal schedule approval at the Initial Design Review Meeting, the Contractor shall continue to provide bi- weekly status reports of the CDR table to the Authority.

The CDR table below provides anticipated timeframes for delivery of items to MBTA for review and approval.

CDR #	Title	Description (for reference only)	Reference	Due By
1	Project Schedule	Overview of Project Meetings and Contact Milestones	RFP 4.3	Kick-off Meeting
2	Production Schedule	Delivery schedule for all 60 buses	RFP 4.4	Kick-off Meeting
3	Pilot Bus Program Plan	Contractor's plan to complete Pilot Bus, should include CDR, Design Review Submittals, and Test Schedules (Contractor to provide bi-weekly updates)	TS 2.5	Kick-off Meeting
4	Structural Inspection Plan	Structural Inspection plan for the Pilot Bus and first four (4) serial production buses	TS 2.6	Kick-off Meeting
5a	Contract Deliverable Requirements (CDR) Schedule	Contractor's plan to complete Pilot Bus, should include CDR, Design Review Submittals, and Test Schedules (Contractor to provide bi-weekly updates as part of the design review process)	TS 2.7	Kick-off Meeting
5b	Design Review Submittals (DRS) Schedule		TS 2.2	Kick-off Meeting
5c	Test Plan and Schedule		TS 2.11	Kick-off Meeting
6	Project Quality Assurance Plan (PQAP) and Inspection Systems	Project quality plan and processes, including workmanship standards, work procedures, and inspection processes	RFP 10	Initial Design Review Meeting
7	Safety Practices and General Workshop Procedures	General facility safety practices and workshop procedures provided to all workers	TS 1.7	Initial Design Review Meeting
8	Approved Equal Submittal Process	Approved equal approval process	TS 2.9	Initial Design Review Meeting
9	Core / Scrap Credits Approach	Core and scrap redemption credit process	RFP 3.15	Initial Design Review Meeting
10	AWS Welding Certifications / Procedures	AWS welding certification submittal for all workers and sample weld procedures	TS 1.9	Initial Design Review Meeting
11	Structural Teardown Report and Serial Production Inspection Plan	Upon execution of the structural inspection plan, a Structural Teardown Report will be completed documenting all findings and recommended approach for serial production buses going forward	TS 2.6	2 weeks after the Initial Design Review Meeting
12	Paint Systems and Procedures	Detailed description of paint preparation, application, and quality processes including providing sample paint chips	TS 3.16.4 TS 3.17.2	Intermediate Design Review Meeting
13	Test Procedures	Detailed test procedure for each test to be conducted on each bus prior to shipment	TS 2.11	Intermediate Design Review Meeting
14	Design Review Submittals	Reference Exhibit 4-1	TS 2.2	Throughout the Design Review Process

Table 3: Contract Deliverables Requirements (CDRs)

Other Requirements				
15	Pilot Bus First Article Inspection	Complete review of Pilot Bus including compliance review of the Technical Specification, functional testing and quality/workmanship review	TS 2.12	Pilot Bus First Article Inspection
16	Special Tools / Test Equipment	Delivery of all special tools and test equipment	TS 2.14	Delivery of 1 st Serial Production Bus
17	New/Improved System and Component Training	OEM certified training classes shall commence no later than 30 days after delivery of the first production bus.	TS 2.15	Schedule/documentation within 30 days of delivery of the Pilot Bus.
18	Parts Renewal & Maintenance Manuals for New Assemblies / Systems	Slide-in inserts to parts and maintenance manuals of all upgraded and new systems (must include OEM part numbers)	2.16	Concept design provided at Pilot Bus FAI, Final manuals provide 4 weeks after delivery of 1 st Serial Production Bus
19	Coach History Book	Documentation of all work performed on bus, including inspections, testing, Hidden Damage, and parts used	TS 2.18	Draft version to be provided at Pilot Bus FAI (and subsequent Coach History Books with each bus delivery)
20	Conformed Receiving Inspection Report	Review of MBTA departure inspection and Contractor's agreement and updates to the current condition of the bus, including identification of Hidden Damage and transportation damage	TS 2.11.2	Sample of Pilot Bus Report at the Initial Design Review Meeting (and subsequent buses within one week of a bus's arrival at the Contractor's facility)

Table 3(continued): Contract Deliverables Requirements (CDRs)

2.8 Subcontractor Qualifications and Procedures

The Authority requires that all subcontractors performing work on the vehicle fleet (or conducting the overhaul of sub-systems) be appropriately qualified. The Authority reserves the right to require documentation of qualification, as well as copies of work procedures, parts lists, and other supplementary information for any subcontractor. The Authority (or their designee) also reserves the right to conduct site visits to any subcontractor facility. These requirements apply to subcontractors performing work both on- site and off-site, and include but are not limited to the following areas:

Item	Description	Spec. Reference
1	Front, and Rear Axle Overhauls	TS 3.1.1 & 3.1.3
2	Engine Replacement	TS 3.7
3	Hybrid Drive Unit Overhaul	TS 3.9
4	Hybrid ESS Supplier	TS 3.9.1
5	Cooling System	TS 3.10
6	HVAC System	TS 3.14

Table 2: Examples of Subcontractor Qualifications and Procedures Required

The Contractor is responsible for submitting all subcontractor qualifications and procedures with the relevant Design Review Submittals. For example, if the Contractor proposes a subcontractor perform a differential rebuild, the Contractor must include subcontractor qualifications and procedures in the Rear Axle Overhaul Design Review Submittal.

2.9 Approved Equal Process

All requests for “approved equal” shall be presented by the Contractor to the Authority’s Technical Project Manager for review and approval using the “Approved Equal Request Form” included in TS Attachment 1. In addition, the Contractor shall track all requests for “approved equal”, whether approved or rejected, using the Approved Equal tracking spreadsheet included in TS Attachment 1. The Contractor shall submit the Approved Equal Tracking Spreadsheet, with all proposed approved equals, at the Initial Design Review meeting.

Throughout this specification, specific products have been identified which are known to satisfy the Authority’s requirements for service proven performance, durability, and overall value. In cases where a specific product is identified by name and/or part number, the Contractor may elect to submit service proven alternative products for the Authority’s consideration. These submittals shall be known as “Requests for Approved Equal” and will be formally submitted for the Authority’s approval. [CDR #8]

When submitting a Request for Approved Equal, the Contractor shall develop a line item compliance matrix which defines the “key characteristics” by which the Contractor can demonstrate that the alternative product being proposed is equivalent or better than the product originally specified.

The Contractor shall provide appropriate supporting documentation (including drawings, a parts sample, materials specifications, product “cut sheets”, test reports, standard warranty statement, and current transit bus fleet users with contact name / phone number / quantity in use) as required to demonstrate equivalence to the Authority’s satisfaction.

Requests for Approved Equal shall be submitted at the kick-off meeting and as early in the Design Review Process as possible to minimize disruptions to the overall process and to maximize time to evaluate/discuss the Request.

The Contractor will be proceeding at risk if any work is performed prior to receiving approval by the Authority.

2.10 Hidden Damage (Out of Scope Work)

This specification describes the base level of work to be performed on all buses. However, buses may enter the bus overhaul program which have damage and/or require repairs beyond the scope identified in the Technical Specification.

The Contractor shall use the Conformed Inspection to identify Hidden Damage and submit to the Authority detailed estimates for repair (including material and labor costs) for the Authority's review. The Authority shall deny, deny and request a revision, or accept the Contractor's Hidden Damage repair proposal. The Contractor shall ensure all materials are ordered promptly upon Hidden Damage repair approval by the Authority. The Contractor shall incorporate all approved repairs into their overhaul production schedule and shall not use Hidden Damage as a reason to request an extension to the overhauled bus delivery schedule. The Contractor shall include Hidden Damage documentation in the Coach History Book for each bus.

Repairs will be required on an as-needed basis. To the greatest extent practical, these items will be identified at the Departure Inspection by the Authority, prior to the bus being turned over to the Contractor. However, it remains the Contractor's responsibility to confirm and/or identify all out of scope (Hidden Damage) items during the Contractor's Receiving Inspection and during the entire production process, which includes up to and including MBTA Resident Inspector final inspection. **Failure to identify Hidden Damage items during the overhaul program does not absolve the Contractor from the responsibility of performing appropriate repairs prior to the return shipment of a bus.**

All work identified in the Technical Specification is considered Basic Work, unless specifically noted as "Hidden Damage". Any work not identified in the specification which is discovered by the contractor shall be presented to the Authority as Hidden Damage for review and/or approval. **The exemption or omission of an item from the Technical Specification does not absolve the Contractor of the responsibility of bringing it to the attention of the Authority for consideration as Hidden Damage.**

Hidden Damage may be identified at the Departure Inspection, Receiving Inspection, or found to be required during the overhaul of the vehicle. Prior to performing any Hidden Damage repairs, a quote for the labor hours and estimated parts using the Hidden Damage Approval Form included in TS Attachment 1 will be provided by the Contractor to the Authority's Resident Inspector for review. Following the review by the Authority's Resident Inspector, the Contractor shall provide the Hidden Damage Approval form to the Authority's Technical Project Manager. The MBTA's Technical Project Manager or his designee must provide approval prior to work proceeding.

The Authority may choose to provide the Contractor with replacement components to address any Hidden Damage items. All repairs shall be performed in accordance with industry standard practices.

For each bus, the Contractor shall maintain a real-time Hidden Damage Tracking Form (reference TS Attachment 1), to track all Hidden Damage work performed. A separate spreadsheet for each bus shall be continually updated throughout the production and provided to the Authority with updates on what has been approved and awaiting approval. The final spreadsheet for each bus, as well as the Hidden Damage Approval Form cover sheets, shall be provided to the Authority's Resident Inspector for verification prior to the release of each bus for shipment and shall be included in the Coach History Book.

2.10.1 Repetitive (As Needed) and Fleetwide Hidden Damage

As part of the Design Review Process, the Contractor shall propose items which are expected to be repetitive in nature. The Authority will review repetitive items and provide approval for quantities and reorder points of parts to be procured in advance to assist with production workflow and alleviate long lead times.

Hidden Damage items which are expected to occur on the majority of the fleet will be considered for fleetwide approval.

2.11 Test Program Plan, Test Procedures, and Test Reports

The Contractor is required to provide a detailed Test Plan (and schedule) at the Intermediate Design Review Meeting. This Test Plan shall describe how the Contractor will validate the satisfactory completion of the bus through testing and shall contain a listing of all tests to be conducted by the Contractor (or sub-contractors). [CDR #5c]

When changes to the Test Plan and Test Schedule are made, updates shall be submitted by the Contractor to the Authority.

To be accepted as proof the overhauled vehicles have met the requirements of the contract, all testing must be conducted in accordance with written Test Procedures and documented on an acceptable Test Report by the QAO or an appropriate designee. Test Procedures shall be submitted to the Authority for review and approval a minimum of one week prior to the anticipated start of the relevant testing. [CDR #13]

Within one (1) week after successful completion of each test, a report shall be provided by the Contractor which summarizes the test results, analyses, and corrective actions. Reports shall include photographs, charts, and additional data to support the test results. Reports must include a statement that certifies conformance to specified requirements. Should the Authority find the data submitted not to be acceptable, the Contractor shall complete the tests as directed by the Authority with no increase in contract cost or extension of the delivery schedule. Notations of the successful completion of each test shall be included in the appropriate Coach History Book.

2.11.1 Departure Inspections

A detailed **Departure Inspection** shall be conducted (by an MBTA representative, and at the Contractor's option with the participation of a Contractor representative) on each of the MBTA's New Flyer forty-foot hybrid buses at the Charlestown garage (or other Authority designated facility) prior to the buses release for shipment from the MBTA. To the maximum extent possible, all known Hidden Damage or extra work (work beyond the scope defined by the Technical Specification), shall be identified on each bus prior to shipment from the MBTA. The Authority will provide a documentation package including photographs. The Contractor is encouraged to provide feedback/input to help optimize this documentation process and form.

2.11.2 Receiving and Conformed Inspections

Upon receipt of buses at the Contractor's facility, a detailed **Receiving Inspection** shall be jointly conducted by the Resident Inspector and Contractor to review the Departure Inspection documentation, identify any shipping damage and identify any additional discrepancies noted at that time.

A **Final Conformed Receiving Inspection Report** shall be prepared by the Contractor and submitted to the Authority for Approval within one (1) week of vehicle arrival at the Contractor's facility. At this time, estimates for any Hidden Damage identified by the Contractor shall be presented to the Authority for review and approval. The Approved Final Receiving Inspection Report shall be included in the Coach History Book.

A sample Receiving Inspection Report and a sample Conformed Inspection Report shall be provided to the Authority for review and approval as the Initial design Review meeting. [CDR #20]

2.11.3 Hold Point Inspections

The Contractor shall identify **Hold Point Inspection Stations** which shall be at the best locations to provide for the work content and characteristics to be inspected.

Hold Point inspection stations shall contain the equipment to inspect structural, electrical, hydraulic, and other components / assemblies such as front, center and rear axles for compliance with the overhaul and/or design requirements.

Stations shall also be at the best locations to inspect or test characteristics before they are concealed by subsequent fabrication or assembly operations. These locations shall include at a minimum underbody structure completion, body framing completion, body prior to paint preparation, water test before interior trim and insulation installation, engine installation completion, underbody dress-up and completion, bus prior to final paint touchup, bus prior to road test, and bus final road test completion.

Defects discovered on Hold Point inspections must be repaired before the bus and/or component can be moved to the next stage of overhaul. A full listing of Hold Point inspection stations and procedures shall be prepared by the Contractor and included in the production plan provided to the Authority for review and approval.

2.11.4 Production Pre-Delivery Tests

The Contractor shall conduct Pre-Delivery tests at its plant on each bus following completion of overhaul and before delivery to the Authority. These pre-delivery tests shall include visual and measured inspections, as well as testing the total bus operation. The tests shall be conducted and documented in accordance with written test procedures, provided by the Contractor and approved by the Authority. [CDR #5c]

The pre-delivery tests shall be scheduled and conducted with a minimum of twenty-four hours' notice so that they may be witnessed by the Resident Inspectors, who may accept or reject the results of the tests. Tests must be conducted during regular business hours. The Resident Inspector will make all reasonable efforts to accommodate the Contractor's schedule. However, at the Authority's request, the Contractor shall repeat or delay testing to allow the Resident Inspector to witness and appropriately document results.

The results of pre-delivery tests, and any other tests, shall be included in each bus Coach History Book.

2.11.4.1 Inspection

Visual and Measured: Visual and measured inspections shall be conducted with the bus in a static condition. The purpose of the inspection testing is to verify that overhauled components are included and are ready for operation.

2.11.4.2 Water Test

As part of the final inspection of the body exterior work, each bus must undergo a water test proposed by the Contractor and approved by the Authority. This water test shall replicate the pressure and direction of water flow seen during operation and cleaning with the bus wash equipment in use at the Authority. Each bus shall be tested to ensure the body, floor, windows, doors, lamps, destination signs, and other openings do not admit water into the interior of the bus or into any compartments covered by exterior doors. Underside tests shall be conducted to simulate water splash by tires and other objects due to heavy rain. Buses that fail the test shall be repaired and retested until they pass.

2.11.4.3 Air System Test

The Contractor shall test each bus to verify the integrity and functionality of the air system. The air system functional tests shall include a system pre-test, reservoir supply leakage test, delivery leakage test, emergency/parking brake and check valve integrity test in line with New Flyer procedures. Following these tests, the Contractor shall perform a total vehicle air system integrity test. During the testing period, the bus shall be isolated, secured, and no work performed. The total air system integrity test requires all air systems to be fully charged (no isolation of components, air lines, valves, etc. is permitted), and the vehicle shall be monitored for 8 hours. Within this period, the air system pressure shall not drop more than 10 psi. Buses that fail these tests shall be corrected, repairs documented, and

retested by the Contractor until they pass. Testing must include verification and proper operation of air build rate, low air warning system, air governor settings, etc. and must comply with all other FMVSS and FMCSA standards.

2.11.4.4 Alignment / Turning Radius Verification

The Contractor shall perform a 'major' all-wheel alignment on the overhauled bus in accordance with OEM standards. The all-wheel alignment shall include rear axle thrust angle and front axle setback checks and adjustment. An electronic printout showing the alignment before and after measurements shall be included in the Coach History Book.

The Contractor shall perform a turning radius test on all completed buses. The turning radius of the vehicle must comply with OEM specifications.

The Contractor shall provide alignment procedures to the Authority for review as part of the design review submittal. All alignment, steering stop adjustment, ride height, and turning radius results shall be included in the Coach History Book.

2.11.4.5 Brake/Stopping Test

The contractor shall review and apply the Massachusetts State DPU, FMVSS and/or CMVSS braking requirements, whichever is most stringent for each of the following braking tests.

- Service Brake
- Emergency Brake
- Parking Brake

2.11.4.6 Total Bus Operation

Total bus operation shall be evaluated during road tests. The purpose of the road tests is to observe and verify the operation of the bus as a system and to verify the functional operation of the subsystems that can be operated only while the bus is in motion, as well as those subsystems which are typically operated in revenue service (lights, stop requests, doors, etc.).

At the time of the road test, the vehicle shall be evaluated for excessive noise during operation. The noise evaluation shall include but is not limited to inappropriate and abnormal engine, ACTM, and axle noise; rattling and squeaking; etc.

Prior to release, each bus shall be driven for a minimum of seventy-five (75) miles, the final twenty-five (25) of which shall be the road performance test. Observed defects shall be recorded on the test forms. The bus shall be retested when defects are corrected, and adjustments are made. This process shall continue until defects or required adjustments are no longer detected. Results shall be pass/fail for these bus operation tests.

2.11.4.7 Verification of Critical Torques

The Contractor shall supply a torqueing procedure and include a list of all Safety Critical torque locations and values.

2.11.4.8 Other Tests

In order to ensure the overhauled bus is in compliance with the specification requirements, additional testing shall be required. Throughout the Technical Specification additional tests are identified. Other testing includes but is not limited to testing of: Paint Gloss/Thickness, Battery/Electrical System, Electrical Storage System (ESS), Cooling System, Hybrid Drive System, ABS Systems, Fire Suppression System, HVAC System, Fastener Torque Values, Wheel Torque Verification, and Wheel Paint Thickness Test.

2.11.5 Resident Inspector Final Inspection and Release Authorization

Once the Contractor deems the overhauled bus complete and all tests including Pre-Delivery tests have been satisfactorily performed, the Contractor shall present the bus to the Resident Inspector for his inspection. The Resident Inspector will be allotted no less than 24 hours access to the completed bus for his inspection. If, during the 24 hours, the Resident Inspector is unable to perform his inspection, whether due to mechanical problem or circumstances beyond his control, the 24 hour clock shall stop and not restart until the Resident Inspector decides he is able to adequately perform the inspection. The Contractor shall stage the bus on a lift and provide a hoist, scaffold or elevated platform (and fall restraint equipment) for the Resident Inspector to easily and safely inspect the bus roof and roof top components. The Resident Inspector will present his findings to the Contractor. The Contractor shall be required to appropriately address all items identified by the Resident Inspector. As items are addressed, the Contractor shall present each to the Resident Inspector for his approval. All defects identified by the Resident Inspector must be addressed before the bus can be returned to the Authority unless prior approval is granted by the Authority's Project Manager.

Delivery of each bus shall require written authorization by the Resident Inspector. Authorization forms for the release of each bus for delivery shall be provided by the Contractor. An executed copy of the authorization shall accompany the delivery of each bus and shall be included in the Coach History Book.

2.11.6 Incoming Inspection

The Authority shall perform an Incoming Inspection upon the overhauled buses return to the MBTA. This detailed inspection shall check the Contractor's conformance to the overhaul requirements and identify any transportation damage and shall be the basis for the Authority's acceptance (conditional or otherwise) of the bus.

Buses will be subject to, and must pass, Massachusetts Motor Vehicles Codes of Inspection and Massachusetts Department of Public Utilities inspections.

2.12 Pilot Bus First Article Inspection

The Pilot Bus First Article Inspection (FAI) involves the physical examination, internal / independent testing of, and acceptance by the Authority of all components, major assemblies, subassemblies, systems, subsystems, and materials manufactured or assembled by either the Contractor or Subcontractors. If required, due to the complexity of the design/installation, the Authority may request individual components, major assemblies, subassemblies, systems, subsystems, and materials be reviewed and approved prior to the Pilot Bus FAI. For example, the overhauled Hybrid Drive Unit may require further evaluation prior to installation in the Pilot Bus.

The FAI of a component that the Contractor is purchasing, rather than manufacturing, is intended to evaluate form, fit, and function of the component. The FAI is usually the first point at which functionality and maintainability of a component or system can be evaluated. At the Authority's discretion, the FAI for purchased components / assemblies may include a source inspection of the Subcontractor / supplier's facilities.

During the Pilot Bus FAI, the Authority will review the Contractor's (and Sub-contractor's) product to verify compliance of quality and workmanship requirements established by the Technical Specification. The Contractor is responsible for maintaining these standards throughout serial production. **[CDR #15]**

The Authority will provide a complete Pilot Bus FAI Findings Report within a week of completion of the Pilot Bus FAI meeting.

The Authority may direct the Contractor to demonstrate, by physical test, conformance to any requirement in the specification.

At the Authority's discretion, test reports that demonstrate full compliance on identical configuration components, may be submitted by the Contractor for Authority acceptance.

2.13 Pilot Bus Tests

The Pilot Bus shall undergo qualification testing to verify that the requirements of this Specification are being met.

2.13.1 Pilot Bus Tests at the Contractor's Facility

The pilot bus shall be tested by the Contractor and witnessed by the Authority's Resident Inspector. In addition to all specified pre-delivery testing, the completed Pilot Bus shall be dynamometer tested to certify engine and ACTM ratings.

The Contractor shall also conduct a brake performance test using a Performance Based Brake Tester (PBBT) to confirm proper brake balance and operation as outlined in APTA BTS-BC-RP-001-05, Rev. 1.

Dynamometer and PBBT generated reports/results shall be presented by the Contractor to the Authority for review during the Pilot Bus FAI and shall be included in the Pilot Bus Coach History Book.

2.13.2 Fluid Capacity Test

All engine and ACTM dipsticks and dipstick tubes on the overhauled vehicles shall be verified to be the correct lengths to ensure correct fluid filling. Dipstick / dipstick tube length shall be validated on the Pilot Bus by the performance of a fluid capacity test and documented as part of the First Article Inspection.

2.13.3 Pilot Bus Tests at the Authority

Upon completion of the Pilot Bus FAI, the Pilot bus shall be delivered to the Authority and shall be used for testing and demonstration on the Authority's property for a one (1) week period.

The Pilot Bus will be tested by the Authority to verify that the performance requirements in this Technical Specification are being achieved. At the end of the one-week Pilot bus test period, the MBTA's Technical Project Manager shall solicit feedback from the MBTA Operations and Maintenance Departments and convey to the Contractor any known problems and required modifications. The Authority approved design configuration defined at that time shall become the "Baseline Design Configuration" and the basis for production of buses 2 through the end of production under this Contract.

2.14 Special Tools and Test Equipment

If special tools are identified by the sub-supplier of an upgraded or new system / component, the Contractor shall supply five (5) complete set of all special tools and test equipment necessary to service and maintain each upgraded or new system. These special tools shall be provided concurrent with the delivery of the first production bus. Special tools are defined as those not readily available from Snap-On. Examples of standard tools are combination wrenches, screw drivers, hammers or tools that would normally be found in a mechanic toolbox. Examples of special tools are temperature adapter, tachometer readers, valve driver, pressure probe, etc. [CDR #16]

The Contractor shall provide five (5) 14-inch laptops, Panasonic Toughbook model CF54. Laptop shall be equipped with Microsoft Windows 10 Pro Operating System, 256GB SSD, i7 – 7600U processor, 32GB RAM. Laptops shall be preloaded with all required software and required licenses/subscriptions for five years from the delivery of the final production bus:

- Microsoft Office Professional; latest version
- Lojack (Absolute Software)
- Cummins diesel engine diagnostic software and license
- BAE Hybrid Drive System diagnostic software and license
- ThermoKing (HVAC) diagnostic software
- EMP diagnostic software
- Vansco (Multiplex System)

- Spheros/Valero (Auxiliary Heater) diagnostic software
- Wabco Toolbox software and subscription

In addition, the following diagnostic equipment/special tools shall be provided:

- Five (5) each of all datalinks / cables (Cummins USB Link 2 and In-Line7 DLAs)
- Five (5) Kvaser J1939 communication interface cables
- Five (5) sets of any other diagnostic / maintenance software and hardware (including harnesses, cables, etc.) not listed above, that are used in the maintenance of the MBTA's New Flyer forty-foot hybrid buses.

2.15 New/Improved System Component Training

If new/improved systems and components are installed on any bus, the Contractor shall be responsible for providing appropriate training in Boston by the system/component OEM to Authority personnel. At a minimum, a two day in-person, hands-on training class shall be conducted by at least one OEM certified instructor. The Contractor shall submit a training schedule and associated training documentation within 30 days of delivery of the Pilot Bus. Training shall commence no later than 30 calendar days after delivery of the first production bus. [CDR #17]

2.16 New/Improved System Software Escrow

In order to protect the Authority from any issues that may arise regarding software required to operate buses in revenue service, the Contractor shall make arrangements to provide a software escrow for new/improved systems and components, that contains all software necessary to operate and make changes to all new/improved electronic systems contained on the buses. The following pertains only to New/Improved System Software.

- The Contractor's escrow policies shall contain an endorsement naming the Authority as an additional insured party and that written notice shall be given to the Authority at least thirty (30) days prior to termination, cancellation or material reduction of coverage in the policy.
- The Contractor shall provide the Authority a list of all OEM software comprising proprietary works ("Proprietary Software") for all major vehicle subsystems and vehicle drawings at the Final Design Review Meeting.
- Source code for the Proprietary Software and all related documentation required for the use and modification thereof, and any revisions or derivative works based on the Proprietary Software developed pursuant to the Contractor's performance of the Contract (collectively, "Escrow Materials") shall be deposited in an escrow account with a third party, as set forth in RFP, Software Escrow Agreement. The Contractor shall pay all initial and future costs related to the escrow account. When necessary, and only upon request, information contained within the listed software will be made available to the Authority through the Contractor and/or OEM of the vehicle subsystem.
- The Contractor and OEM are not obligated to provide copies of source code, as this is proprietary intellectual property; however, the Contractor is obligated to assist the Authority with any technical assistance for the duration of the life of the vehicle. Such assistance provided by the Contractor shall include software updates, deployment documentation and upgrade compatibility confirmation.
- The Contractor shall maintain current versions of all software in escrow and shall ensure all new software revisions and upgrades are provided to the escrow agent. In the event the source code provider files for bankruptcy or fails to maintain or provide necessary software upgrades, the Contractor shall be responsible for developing and providing replacement software. The escrow materials shall immediately be obtainable and usable by the Authority in the event the Contractor fails to support the continued use of the Proprietary Software by the Authority, or upon termination or expiration of the term of the escrow.

2.17 Manuals

The Authority requires maintenance, operational, and parts manuals (including OEM/manufacture's part numbers) be provided for all upgraded and new systems / equipment installed on the bus. These manuals shall provide additional information to support the existing New Flyer manuals in order to maintain, operate, and order OEM parts as required. [CDR #18]

The manuals including all text and images, shall be provided in an electronic media consistent with industry standards. The Authority's preferred format is Adobe PDF. Appropriate navigation and frame structures shall be provided within these documents. It is encouraged that electronic linkages exist with the vendor to enhance customer support opportunities, including e-mail. Concept design of this electronic documentation will be presented during the Pilot Bus First Article Inspection.

Two (2) draft printed hard copies of all manuals shall be furnished with the delivery of the Pilot Bus. A copy of the manuals for similar equipment with notation to reflect required changes for the MBTA buses are acceptable for this submittal.

Concurrent with the delivery of the first serial production bus, the Contractor shall furnish to the Authority five (5) copies (on approved electronic media) of interim manuals (model specific content) for all applicable "Special Listings", "Maintenance Manuals", "Operational Manuals", and "Parts Manuals" for the new equipment furnished under the Specification. This shall include electrical prints, pneumatic diagrams and hydraulic diagrams.

Four (4) weeks after the delivery of the first production bus, the Contractor shall provide five (5) printed copies of all final manuals complete with all applicable revisions included and inserted. At this time, five (5) electronic copies of these manuals shall also be submitted in Adobe PDF or approved equal format, on USB flash drives. This PDF document shall allow footnotes, updates, comments or clarifications to be made and saved. Electronic files, regardless of format shall allow updates or changes at a later date by the Authority.

In the event that any significant changes to the vehicle (components, systems, or configuration) are made after the approval of the final manuals, updated manuals or modified page inserts shall be provided by the Contractor.

2.18 Coach History Book

The Contractor shall provide a draft Coach History Book for review at the Pilot Bus First Article Inspection. Coach History Books must be provided with each production bus, at time of delivery, on a form of electronic media. [CDR #19]

Each Coach History Book shall contain the following information at a minimum:

- Description of modifications and dates of completion
- Bill of Materials (BOM) including OEM part numbers
- List of serial numbered components
- Structural Inspection report and findings
- All completed test procedures and test reports
- All completed inspections
- Hidden Damage work orders
- Shipping exceptions and unresolved/open issues

At the Authority's discretion, additional documentation may be added for the Contractor's inclusion in the Coach

History Book.

3. Scope of Work

The following Scope of Work is that which the Contractor is required to complete on all vehicles in the program. Please note, any lists, charts, tables, graphics, etc. are for reference and are not intended to be comprehensive. The contractor will be responsible for verification of the completeness. Should questions or concerns arise related to the Authority's desired extent of completeness of a section, they shall be brought to their attention through an appropriately submitted Request for Clarification (RFC).

3.1 Front Axle and Suspension

All persons working on the front axle and associated subsystems must be appropriately trained to work on MAN axles. All work shall be completed to OEM specifications and in accordance with the latest version of MAN's maintenance procedures.

The following work scope, part numbers, and applicable work procedures and subcontractors shall be submitted by the Contractor and reviewed by Authority as part of the design review process. **[DRS #3]**

3.1.1 Front Axle

The Contractor shall disassemble rebuild and reinstall the front axle in line with OEM specifications as part of basic work. The Contractor's rebuild process shall include cleaning, corrosion removal, crack detection inspection, and paint of the axle and axle components. All fasteners are to be torqued to OEM specifications.

All front axle components shall be replaced by the Contractor with new OEM components, to include but are not limited to:

- Frame rail (axle) suspension bumpers
- Kingpins (including bushings, seals)
- Center link assembly including both ends, tube, clamps, and hardware
- Drag link assembly (including clamps and hardware)
- Shims
- All hardware

The Contractor shall inspect and re-use the following components:

- Beam, front axle
- Knuckles
- Steering arm rear streetside
- Streetside and Curbside Tire rod arms

The Contractor is responsible for inspection of all front axle components including those not mentioned above. If found out of specification, they shall be brought to the attention of the Resident Inspector for Hidden Damage replacement consideration.

3.1.2 Front Hubs and Brake System

The Contractor shall rebuild the front hub and brake system to OEM specifications with all new OEM components (including hardware). The Contractor shall torque all fasteners to OEM specifications.

Front hub and brake system components to be replaced by the Contractor with new OEM components include but are not limited to:

- Hub and bearing assembly (including pulse wheel)
- Thrust Washers

- Lock Nuts
- Wheel hub flange
- Wheel hub flange to bearing hub assembly hardware
- Wheel Studs
- Brake Rotors
- Complete caliper assemblies including carriers, guide pins, tappets, seals, boots, shear adapters etc.
- Caliper and carrier mounting hardware
- Brake Pads
- Lug nuts
- ABS sensors and clampring sleeves,
- Brake hose assemblies
- Brake chambers, vent elbows, and mounting nuts
- All other hardware (including nuts, bolts, studs, washers, brake hose brackets and spacers, cable ties, screws, cushioned p-clamps, etc.)

The Contractor shall ensure all brake hoses are installed and secured in a fashion that will prevent brake hose chafing while the bus is in service.

3.1.3 Front Suspension

The Contractor shall rebuild the front suspension in line with OEM specifications, using new OEM components. All fasteners are to be torqued to OEM specifications.

Front suspension components to be replaced by the Contractor with new include but are not limited to:

- Shock absorbers including all mounting hardware and rubber bushings, etc.
- Air springs (bellows) including all mounting hardware and air fittings
- Radius Rod assemblies (upper and lower complete including all bushings, ball joints, snap rings, and circlips etc.)
- All hardware (includes all radius rod, air bag and shock absorber mounting nuts, bolts, washers. Screws, shims, etc.)
- Suspension bumpers

The Contractor is responsible for inspection of all front suspension components including those not mentioned above. If found out of specification, they shall be brought to the attention of the Resident Inspector for Hidden Damage replacement consideration.

3.2 Rear Axle and Suspension

All persons working on the rear axle and associated subsystems must be appropriately trained to work on MAN axles. All work shall be completed to OEM specifications and in accordance with the latest version of MAN's maintenance procedures.

The following work scope, part numbers, and applicable work procedures and subcontractors shall be submitted by the Contractor and reviewed by Authority as part of the design review process. **[DRS #4]**

3.2.1 Rear Axle

The Contractor shall disassemble rebuild and reinstall the rear axle in line with OEM specifications as part of basic work. The Contractor's rebuild process shall include cleaning, corrosion removal, inspection (including inspection for cracks and weld integrity), and paint of the axle and components. All fasteners are to be torqued to

OEM specifications.

A sample of the gear oil from each rear axle shall be obtained during the Contractor's Conformed Inspection and evaluated by an independent laboratory for metal shavings or other evidence of differential damage or wear. Oil sample reports shall be presented to both the Authority's Technical Project Manager and Resident Inspector for review with a copy to be included in the Coach History Book. Differential replacement shall be at the sole discretion of the Authority. If a differential replacement is needed, a remanufactured differential assembly using OEM components shall be installed by the Contractor as Hidden damage.

The Contractor shall perform the following as part of their rear axle rebuild process,

- Replace differential pinion seal and lock nut
- Replace breather filter assembly, plug connections, and hose
- Replace axle to beam U-bolts, nuts, and washers
- Drain, flush, and refill the axle with new synthetic gear oil
- Hubometer replacement with new Stemco or Authority approved equal

The Contractor shall inspect and reuse the following components:

- Rear axle housing
- Shaft, axle, L.H.
- Shaft, axle, R.H.
- Radius Rod mounting blocks
- Magnetic drain plug

The Contractor is responsible for inspection of all rear axle components including those not mentioned above. If any rear axle component is found out of specification, they shall be brought to the attention of the Resident Inspector for Hidden Damage replacement consideration.

3.2.2 Rear Hubs and Brake System

The Contractor shall rebuild the rear hub and brake system to OEM specifications with all new OEM components (including hardware). The Contractor shall torque all fasteners to OEM specifications.

Rear hub and brake system components to be replaced by the Contractor with new OEM components include but are not limited to:

- Hub unit bearings (including shaft seal and pulse wheel)
- Thrust Washers
- Slotted Nuts
- Wheel hubs
- Rotor to hub hardware
- Wheel Studs
- Brake Rotors
- Complete caliper assemblies including carriers, guide pins, tappets, seals, boots, shear adapters etc.
- Caliper and carrier mounting hardware
- Brake Pads
- Lug nuts
- ABS sensors assemblies, hose clamps, lock screws, cable guides, cable ties, and ABS sensor brackets
- Brake hose assemblies
- Brake chambers, vent elbows and tubes, and mounting nuts

- All other hardware (including nuts, bolts, studs, washers, brake hose brackets and spacers, cable ties, screws, cushioned p-clamps, etc.)

The Contractor shall ensure all brake hoses are installed and secured in a fashion that will prevent brake hose chafing while the bus is in service.

The Contractor is responsible for inspection of all rear hub and brake components including those not mentioned above. If any rear hub and brake component is found out of specification, they shall be brought to the attention of the Resident Inspector for Hidden Damage replacement consideration.

3.2.3 Rear Suspension

The Contractor shall overhaul the rear suspension in line with OEM specifications, using new OEM components. All fasteners are to be torqued to OEM specifications.

Rear suspension beams shall be thoroughly cleaned including the removal of all corrosion. The Contractor shall inspect all surfaces and welds for signs of cracking and excessive loss of original material thickness. The Contractor shall pay particular attention to the structural attachment points for the torque rods, as well as all airbag/shock mounting areas. The Contractor shall treat the beams with a rust inhibitor and paint to reduce future corrosion.

Rear suspension components to be replaced by the Contractor with new include but are not limited to:

- Shock absorbers including all mounting plates, shock mounting brackets, mounting hardware and rubber bushings, etc.
- Air springs (bellows) including all mounting hardware and air fittings
- Radius Rod assemblies (upper and lower complete including all bushings, ball joints, snap rings, and circlips etc.)
- All hardware (includes all radius rod, air bag and shock absorber mounting nuts, bolts, washers, spacers, screws, shims, etc.)
- Suspension bumpers

Components to be inspected and reused include:

- Axle beam assemblies
- Jacking pads
- Dowel pins
- Spacer pads

The Contractor is responsible for inspection of all rear suspension components including those not mentioned above. If found out of specification, they shall be brought to the attention of the Resident Inspector for Hidden Damage replacement consideration.

The Contractor shall submit an axle beam inspection, corrosion abatement process, and work procedure as part of the Design Review Process.

3.3 ABS System

The Contractor shall overhaul the ABS system in line with OEM specifications using new OEM parts/components. All components and fasteners are to be installed and torqued to OEM specifications.

ABS components shall be replaced by the Contractor with new including but not limited to:

- All front and rear ABS sensors
- Front and rear modulator valve assemblies (including pressure switches)
- Front and rear Quick Release valves
- Rear brake relay valves
- Double check valves
- ATC valves

The contractor shall perform a full function test to confirm proper operation of the ABS system. The Contractor shall submit their ABS test procedure during the Design Review Process.

3.4 Wheels & Tires

All six (6) wheels on each bus shall be replaced with new. Wheels shall be ten hole ventilated tubeless hub piloted and shall be integral formed steel drop center construction. Wheels shall be Accuride or Authority approved equal. Wheels shall be powder coated gloss black with a paint thickness of no greater than 3.5 mils on all mating/mounting surfaces. Wheel paint thickness shall be certified by the wheel manufacturer. The Contractor is responsible for auditing / verifying the paint thickness at an appropriate interval, utilizing industry standard testing methodology. The Authority reserves the right to verify wheel paint thickness at any time. All removed wheels shall be returned to the Authority.

Two new tires will be provided by the Authority for use on the front axle of each coach. The four (4) tires for the rear axle shall be selected by the Contractor from tires removed on production coaches and matched within 2/32" at the axle end and 4/32" across the axle. All tires shall be mounted / remounted and balanced in accordance with the manufacturer's recommended practices. All appropriate safety precautions shall be taken for mounting and inflating tires. All tires shall be torqued per the Authority's wheel torque procedure. The Contractor is responsible for tracking and returning all tires to the Authority.

All valves and valve stems shall be replaced with new. High temperature valves and seals shall be used, (Dill Air Controls P/N TR570E14GNC), and alligator style inflate through valve caps shall be installed in an orientation that allows easy check and fill of inner tires in a dual tire application.

3.5 Driveshaft and Guard

The Contractor shall remove, rebuild, and reinstall the driveshaft in line with OEM specifications and procedures using new OEM parts/components. All components and fasteners are to be installed and torqued to OEM specifications.

The Contractor shall include in their driveshaft rebuild work process the inspection of driveshaft tubes, yokes, and flanges, and the replacement of all u-joints, lock plates, bearing straps, and hardware with new OEM as part of basic work. All rebuilt driveshafts shall be cleaned, painted, and balanced prior to installation. Please note driveshaft components are part of a balanced assembly and must be reassembled using the original driveshaft ends (reference New Flyer TSIB 12-01 rev A).

The Contractor shall inspect the driveshaft guard. Any missing guard, missing guard hardware, cracked or distorted guard shall be brought to the attention of the Resident Inspector for Hidden Damage replacement consideration.

If any driveshaft component is found out of specification, they shall be brought to the attention of the Resident Inspector by the Contractor for Hidden Damage replacement consideration.

3.6 Steering

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. **[DRS #5]**

The Contractor shall rebuild the steering system in line with OEM specifications. The following steering components shall be replaced with new including but not limited to:

- Drag link assembly (including ends, tube, clamps, and hardware)
- Steering wheel (including horn button assembly)
- Tilt steering column assembly, including steering shaft and upper shaft assembly (including u-joints), and all covers
- Steering gear box assembly (including pitman arm and transducer)
- Mitre box
- Lower steering shaft (miter box to steering shaft and U-joints)
- All flexible steering hydraulic lines and hose assemblies complete with corrosion resistant fittings
- Power steering filter
- Power steering system pressure fill fitting and dust cap
- Power steering pump
- Steering damper and mounting hardware
- All hardware and fasteners are to be replaced with new and torqued to OEM specifications.

All hoses shall be properly routed and secured with p-clips or Authority approved alternative method. Steering fluid reservoirs shall be inspected for leaks and corrosion. Steering fluid reservoirs shall be cleaned (interior and exterior).

All power steering hard lines, fittings, and connections shall be inspected for leaks, corrosion, and other damage. Fittings exhibiting surface corrosion shall be cleaned. Any significant corrosion or other damage to fittings and hard lines shall be brought to the attention of the Resident Inspector for Hidden Damage replacement consideration.

The Contractor is responsible for inspection of all steering system components, mounts, and brackets, including those not mentioned above. If found out of specification, they shall be brought to the attention of the Resident Inspector for Hidden Damage replacement consideration.

The hydraulic system shall be re-filled per OEM recommended procedure and tested to confirm no system leaks are present and correct pressures are observed during normal operation and at steering limits.

The Contractor shall perform a 'major' all-wheel alignment on the bus in accordance with OEM standards. The all-wheel alignment shall include rear axle thrust angle and front axle setback checks and adjustment. An electronic printout showing the alignment before and after measurements shall be included in the Coach History Book.

The Contractor shall provide alignment procedures to the Authority for review as part of the design review submittal. All alignment, steering stop adjustment, ride height, and turning radius results shall be included in the Coach History Book.

3.7 Engine

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. **[DRS #6]**

3.7.1 Engine and Accessories

The existing Cummins ISB 6.7L diesel engine shall be removed and replaced by the Contractor with a new Buy America and EPA compliant OEM Cummins ISB 6.7L diesel engine. All engine serial numbers (original and replacement) shall be recorded in the Coach History Book. The new engine shall be equipped with a magnetic drain plug.

The Contractor shall replace the following with new OEM components including but not limited to (unless specifically stated otherwise):

- Engine wiring harness
- Chassis side engine wiring harness
- NOx sensor assembly and isolators
- TBAP sensor
- Oil, fuel, and coolant filters
- Crankcase breather filter
- All lines, hoses, and fittings in engine compartment
- All hose clamps and exhaust/intake clamps
- All hose and harness securement hardware/retainers in engine compartment
- Air cleaner and housing assembly, including primary and secondary filters, body assembly, access door with seal, u-clips, installation clamps, rubber elbows, and air restriction indicator
- Engine mounts, including rear mounts and all associated hardware
- All drive belts and tensioners
- Dipstick and tube
- Engine compartment gauge and CAN communicator

The Contractor shall inspect the air cleaner intake box for damage.

The Contractor shall refurbish the engine switch box which shall include the replacement of all switches and indicator lamps. The switch box shall interior and exterior shall be cleaned. The Contractor shall remove and replace all broken switch box cover fasteners. The Contractor shall check for proper operation of the engine gauge and CAN communicator. The Contractor shall identify missing or damaged diagnostic port covers, and electrical connectors and bring to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

The Contractor shall address corrosion and powder coat all engine compartment belt guard assemblies. The Contractor shall identify missing or damaged belt guards, latches, rubber bumpers, etc. and bring to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

The Contractor is responsible for conformance to all EPA engine replacement and disposal policies.

3.7.2 Exhaust and Aftertreatment System

The Contractor shall overhaul the exhaust and aftertreatment system in line with OEM standards. The Contractor shall replace the entire exhaust and aftertreatment system with new OEM components. This includes but is not limited to the following:

- Complete DPF assembly, which shall include the inlet section (and diesel oxidation catalyst), particulate filter, outlet section, all temperature sensors, both differential pressure sensors, sensor table, wire harnesses, clamps, gaskets, and all associated hardware
- Complete Selective Catalytic Reduction (SCR) unit which shall include SCR decomposition reactor assembly, injector (doser) unit, SCR aftertreatment device, SCR electronic control module (including filter), SCR 24v system valve, all temperature sensors, wire harnesses, DEF and coolant hoses, clamps,

gaskets, straps, heatshields, and all hardware

- SCR Dosing Supply Unit which shall include the SCR supply module, DEF tank, DEF tank straps, DEF tank filler neck and cap assembly, DEF tank head assembly, drain plug, level sender, filter, insulation, rubber channels, hoses, clamps, O-ring, and hardware
- Both NOx sensors and harnesses
- NOx module and isolators
- All DEF hose assemblies
- All coolant hose assemblies
- SCR coolant valve
- All hardware (including nuts, bolts, screws, washers, all fittings (barbed, adapter, straight, etc.), clamps, seals, gaskets, etc.)
- Flex connector (bellows)
- Replace all exhaust blankets
- DPF compartment heat shielding
- Exhaust tail pipe and clamps

The Contractor shall remove, clean and reinstall the SCR supply module cover.

The Contractor shall inspect, clean, and apply a corrosion protective finish to the DEF tank mounts. The Contractor shall identify broken, cracked, or damaged tank mounts and bring to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

The Contractor shall fill the DEF tank with new DEF fluid.

The Contractor shall follow OEM procedures using the appropriate alignment tool for the installation of the flex connector.

The Contractor shall notify the Authority of all available OEM upgrades for review and approval.

The Contractor shall provide an exhaust regeneration system test procedure designed to confirm proper operation of the system as part of the design review process.

The Contractor shall return the complete DPF assemblies to the Authority. The Contractor shall ensure the DPF assemblies are removed from the bus, stored and transported to the Authority in a manner that will eliminate component damage.

3.8 Fire Suppression System

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. **[DRS #7]**

The Contractor shall refurbish the fire detection/suppression system to Amerex OEM specifications. The agent dispersal system shall be blown out and properly cleaned. The agent cylinder (canister) shall be replaced with a new OEM cylinder. Agent cylinder certification must be within six (6) months of installation. The agent cylinder must be installed in such a way that the certification and gauge is easily visible without removing the cylinder from the vehicle.

The Contractor shall replace the following with new OEM components:

- Discharge nozzles and caps
- Control head/actuator assembly

- All thermostats (Fenwal only)
- Fire suppression nozzles and dust caps
- End-of-line modules
- Actuator (control head and firing pin assembly)
- Agent cylinder
- Driver's actuation switch and seal
- Backup battery

Thermostats and backup batteries shall be installed within the first six (6) months of the manufacture date.

The Contractor shall perform a full fire suppression systems test confirming proper operation of all sensors, control module, display panel, switches, and backup battery.

Fire suppression system refurbishment and test procedure shall be submitted to the Authority for review and approval. Appropriate system certification documentation and test results shall be provided in the Coach History Book.

3.9 Hybrid Drive System

All persons working on the Hybrid Drive system and associated subsystems must be appropriately trained and certified by BAE. All work shall be completed to OEM specifications and in accordance with the latest version of BAE's "SYSTEM MANUAL FOR HYBRIDRIVE® Propulsion System for Model No. HDS200". The Contractor shall be responsible for working with BAE to develop the appropriate scope of work for the overhaul of the Hybrid Drive system.

The work scope, components, and applicable work procedures required as part of the Hybrid Drive System overhaul shall be submitted by the Contractor and reviewed by Authority as part of the design review process.

The Contractor is responsible for conducting diagnostic testing and fault isolation of the Hybrid Drive system using Built-In-Test (BIT) diagnostics and Intuitive Diagnostic System (IDS) software to verify the system is operating to OEM specifications. Any issues found shall be brought to the attention of the resident inspector for consideration and possible actions to be addressed under Hidden Damage.

The Contractor is responsible for establishing an inspection procedure to verify the condition of all high voltage cables and clamps, in line with New Flyer ITS-6246 Rev E and ITS-6394 Rev E. The Contractor shall remove all self-amalgamated tape and inspect the covered areas. Adhesive lined heat shrink shall be installed with appropriate clamps on cables that are deemed acceptable. Inspection results shall be presented to the Authority for review. Cables and clamps that do not meet minimum OEM standards shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration. The Contractor shall follow New Flyer ITS-6201 in the event cables need to be replaced. All findings shall be included in the Coach History Book.

The Contractor shall inspect and clean all major component ground cable locations and inspect all high voltage shield bands, in-line with procedures in New Flyer ITS 6207. Damaged shield bands shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

All cable tray covers shall be removed for inspection of all components (including clamps, cables, etc.). All cable trays are to be refinished/painted. All cable trays will be reassembled with new stainless-steel hardware. Any damaged components found shall be brought to the attention of the resident inspector for Hidden Damage consideration.

The Contractor is responsible for confirming that the latest OEM parts revision(s), torque, and work procedures are

being used for rebuilding each hybrid drive system, cabling, and/or components. All work procedures including torque values and verification, and Bill of Materials (BOM) for the overhaul of each component shall be presented to the Authority for approval as part of the Design Review Process. **[DRS #8]**

3.9.1 Energy Storage System (ESS)

The Energy Storage System (ESS) shall be removed, cleaned, inspected, and tested in line with OEM recommended procedures. Overhaul of the ESS shall include but will not be limited to the replacement of the following components with new OEM:

- All associated mounting hardware with new OEM
- Intake and exhaust filters
- Internal ESS components including the following in Table 5 below

Part	Part Number*	Qty Per ESS*
Module Liner	115E6515G1	16
Module	402335-008	16
Contactor	115E6551G2	4
Module to Module Comm Cable	236C1470G1	16
Cooling Fan	400282-002	2
Heater Assembly, Kit	402872-001	1
Battery Management System Module	400291-001/2	1
High Voltage Fuse	400287-002	3

***Contractor responsible for verification of part numbers and quantities**

Table 3: ESS components to be replaced with new

All hardware and fasteners are to be torqued to OEM specifications.

Modules shall be installed within the first six (6) months of the manufacture date.

3.9.2 Auxiliary Power System (APS)

The Auxiliary Power System (APS) shall be removed, cleaned, inspected, and tested in line with OEM recommended procedures. The overhaul of the APS shall include but will not be limited to the replacement of the following with new OEM components:

- Vibration mounts, O-rings, and isolators
- All associated mounting hardware with new OEM

As part of the design review process, the roof mounted grounding point for the APS shall be redesigned. The new design shall be appropriate for the service environment and resistant to the accumulation of debris. The Contractor shall collaborate with the OEM to ensure the ground point relocation meets or exceeds OEM requirements. **[DRS #8]**

All hardware and fasteners are to be torqued to OEM specifications.

3.9.3 Propulsion Control System (PCS)

The Propulsion Control System (PCS) shall be removed, cleaned, inspected, and tested in line with OEM recommended procedures. Overhaul of the PCS shall include but will not be limited to the replacement of the following with new OEM components:

- Vibration mounts, O-rings, and isolators
- All associated mounting hardware with new OEM

All hardware and fasteners are to be torqued to OEM specifications.

3.9.4 Integrated Starter Generator (ISG), Alternating Current Traction Motor (ACTM), and Planetary Speed Reducing Gearbox (PSR)

The Integrated Starter Generator (ISG) shall be removed, cleaned, inspected, and tested in line with OEM recommended procedures.

The Alternating Current Traction Motor (ACTM) shall be removed, cleaned, inspected, tested, and overhauled to OEM specifications with overhaul kit part number 364A7261G1/G2 by a BAE authorized service provider.

The Planetary Speed Reducing (PSR) Gearbox shall be removed, cleaned, inspected, tested, and overhauled to OEM specifications using the parts in procedures specified in BAE service manual ACS 17178.

The integral oil to coolant heat exchanger shall be replaced.

The ACTM oil pump shall be replaced.

The Contractor, working with BAE, shall present a more robust external sensor and cable connections as part of the design review process for MBTA review and approval. This upgrade will provide the necessary updates to the system to eliminate the ACTM hall effect speed sensor. **[DRS #8]**

All hardware and fasteners are to be torqued to OEM specifications.

3.10 Cooling Systems

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. **[DRS #9]**

3.10.1 Engine Cooling System/Charge Air Cooler (CAC)

The Contractor shall replace the existing 9-fan EMP cooling system in its entirety, with a new EMP MH-5 cooling system package. The Contractor shall work with EMP to confirm the new MH-5 cooling package has all required components to ensure completeness of retrofit kit, ease of retrofit, validation of the new cooling system and integration of components, ensure proper engine compartment air flow and control of engine compartment temperatures, and confirm the new cooling system package meets Cummins and BAE performance requirements. The Pilot Bus will be used to verify the form, fit, and finish of the system installation.

The Contractor shall provide work procedures, as-built drawings and final installation configuration documentation to the Authority as part of the design review process and successful completion of the Pilot Bus First Article Inspection.

New cooling system installation kit shall include, but is not limited to:

- Radiator/charge air cooler/traction motor heat exchanger assembly

- All coolant and CAC tubing/piping/hoses between EMP system and engine
- OEM coolant system pressure fill and test port assemblies
- All wire harnesses
- Fan reverse button, LED diagnostic lamp, and mounting bracket
- All hardware including clamps, brackets, nuts, bolts, screws, washers, etc.
- On-board diagnostics interface with bus J1939 network

The Contractor is responsible for any additional components that may be required to integrate the new cooling system with the existing bus configuration.

The buses were originally equipped with an EMP supplied coolant pump in the hybrid drive cooler circuit. New Flyer has approved the use of an Ametek-Rottron coolant pump in this application. The Contractor is responsible for replacement of all engine compartment hybrid drive unit coolant pumps with the New Flyer approved Ametek-Rottron pump, including any changes to wiring and connectors, plumbing, and circuit controls. The Contractor shall provide documentation of retrofit procedures (including New Flyer concurrence) to the Authority for review and approval as part of the design review process.

The Contractor shall provide three (3) electronic copies (PDF format) of the installation and component drawings for the EMP radiator; and three (3) electronic copies (PDF format) and five (5) paper copies of all Maintenance and Part Manuals for the EMP radiator cooling system to the Authority.

3.10.2 Hybrid Drive Traction Motor Cooling

The Hybrid drive traction motor cooling system utilizes a separate heat exchanger located between the charge air cooler and engine coolant heat exchanger as part of the EMP radiator package subject to the retrofit identified in Section 3.10.1.

The Contractor shall inspect the hybrid drive coolant reservoir for cracks and integrity and shall report findings to the Authority for review.

The Contractor shall replace the following hybrid drive traction motor cooling system components with new OEM:

- Heat exchanger (part of EMP radiator package)
- Coolant booster pump (Ametek-Rottron only – see Section 3.10.1)
- All hoses, fittings, and lines in the traction motor/generator cooling circuit
- Integral oil to coolant heat exchanger (part of hybrid drive unit overhaul)
- Traction motor coolant reservoir pressure relief cap, fluid level gauge, and Schrader valve
- All clamps and hardware

The Contractor shall refill, test, and confirm proper hybrid drive traction motor cooling system operation per BAE and New Flyer requirements.

3.10.3 Hybrid Electronics Cooling Package (ECP)

The Contractor shall refurbish the Hybrid Electronics Cooling Package in line with OEM (BAE/EMP) specifications.

The Contractor shall work with BAE/EMP to develop an appropriate overhaul procedure. At a minimum the following shall be replaced with the following new OEM components:

- All hoses and clamps
- Mounting Brackets and Hardware

- Vibration Isolators
- Fan Assemblies
- All Sensors
- Fill cap
- Coolant pump

The Contractor shall refill, test, and confirm proper ECP system operation per BAE requirements.

The Authority has experienced failures of ECP coolant pump. The Contractor shall work with BAE to identify a more robust pump for this application and all procedures required for a retrofit. The Contractor shall provide an ECP system overhaul work procedure, test procedure, bill of materials, ECP retrofit documentation and procedures to the Authority for review and approval as part of the design review process.

3.10.4 Engine Surge Tank and Coolant Recovery Tank

The Contractor shall inspect the coolant recovery tank and surge tanks for cracks and integrity, and findings shall be reported to the Authority for review. The Contractor shall pressure test the surge tank in line with OEM specifications.

Surge tank assembly components to be replaced with new OEM components:

- Pressure cap assembly
- Schrader valve
- All coolant level sensors
- Coolant level gauge
- Coolant recovery tank vented cap and barbed fitting
- All surge tank and coolant recovery system hoses, fittings, clamps, and hardware

Damaged or leaking engine coolant recovery and surge tanks shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

3.10.5 Engine and Attic Compartment Configuration

The Contractor shall replace all engine and attic compartment hoses and hardware with new in accordance with OEM specifications. Hoses shall be individually supported using stainless steel insulated p-clamps where appropriate. A minimum separation of ½” shall be present between hoses, and a minimum clearance of ½” shall be present between hoses and any part of the bus. The Contractor shall present their engine and attic compartment configuration for review and approval as part of the Pilot Bus First Article Inspection.

3.11 Fuel System

The following work scope, part numbers, and applicable work procedures shall be submitted by Contractor and reviewed by Authority as part of the design review process. [DRS #10]

3.11.1 Fuel tanks

The Contractor shall inspect the fuel tank, fuel fill, plumbing, fuel level sending unit, and all mounting locations/hardware/neoprene isolator strips/tank restraining straps. Findings shall be reported to the Authority for review. Compromised fuel tanks or associated equipment shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

The Contractor shall clean the underside of the fuel tank and apply new Authority approved undercoating.

3.11.2 Fuel Filters/Lines

The Contractor shall replace fuel filters and flexible fuel hose and hose assemblies with new in line with OEM specifications. Hard fuel lines shall be inspected, and findings shall be reported to the Authority for review. Compromised hard fuel lines and associated equipment shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

3.12 Air System

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. [DRS #11]

The Contractor shall inspect all air lines, hoses, pipes, etc. which comprise the bus air system. Any damage shall be brought to the attention of the Resident Inspector for Hidden Damage consideration. Air hose and tube splicing is not allowed unless specifically approved by the Authority. Any pre-existing splices shall be brought to the attention of the Authority and Resident Inspector for Hidden Damage consideration.

The rubber hoses connecting the brake valves to the brake chambers on both front and rear axles shall be replaced with new OEM brake hose assemblies in line with FMVSS 106.

The Contractor shall replace all air system, brake, and suspension valves with new OEM valves, including brake system valves, modulator valves, leveling valves and linkage, kneeling valves, kneeling recovery valves, check valves, dump valves, etc. The following list is provided for reference only:

- Quick release valves
- Relay valves
- Pressure reducing valves
- Pressure protection valves
- Double check valves
- Check valves
- ATC valve
- Spring brake modulating valves
- Treadle valve
- PP-1 valve
- Emergency brake release valve
- ABS modulator valves
- Interlock pressure regulator valve
- Interlock solenoid valve
- Leveling valves and linkage
- Kneeling valve assembly including all valves, solenoids, and coil assembly
- MV8 solenoid valve
- Dump valves
- ST1 safety valves
- Auto drain valve assembly

Leveling valve linkages shall be properly configured in line with OEM instructions to prevent “flipping” in service and interference with other components.

The Contractor shall test and confirm proper operation of all air system transducers, air pressure senders, air pressure switches, brake application pressure transducer and brake tank pressure sending units. Test results shall be presented to the Authority for review. Any out of specification components shall be brought to the attention

of the Resident Inspector for Hidden Damage replacement consideration.

Flexible air hoses shall meet material requirements of SAE Standard J844-Type 3B for nylon tubing if not subject to temperatures over 200° F. Accessory and other noncritical lines may use Type 3A tubing. Nylon tubing shall be installed in accordance with the following color-coding standards:

- A) Green Indicates primary brakes and supply
- B) Red: Indicates secondary brakes
- C) Brown: Indicates parking brake
- D) Yellow: Indicates compressor governor signal
- E) Black: Indicates accessories
- F) Blue: Indicates suspension.

Lines shall be supported to prevent movement, flexing, tension strain, and vibration at no more than 2-foot intervals, and if replaced, the securement method shall be inspected by the Resident Inspector. Air lines shall be cleaned and blown out before installation and shall be installed to minimize air leaks. All new or reinstalled air lines shall be sloped toward a reservoir and routed to prevent water traps. Grommets shall protect the air lines at all points where they pass through understructure components.

The Contractor shall perform an air system test per Section 2.11.4.3.

3.12.1 Air Compressor

The Contractor shall replace air compressor and clutch assembly, induction drive motor assembly (including thermistor), drive belts, rubber mounts and hardware, remote filter and inlet hose with new OEM components. The Contractor shall powder coat the belt guard and replace all warning labels as part of basic work.

The Contractor shall propose a relocation of the compressor air filter so as to provide for ease of maintenance and reduce the filter contamination from road dirt and debris, as part of the design review process.

3.12.2 Air Dryer Assembly

The Contractor shall replace the AD-9 tandem air dryer assembly and associated hardware with a new OEM AD-9 tandem assembly. The Contractor shall also replace the air dryer control solenoid assembly and all air hose assemblies.

3.12.3 Air Tanks

The Contractor shall drain, clean and inspect all air tanks. The Contractor shall present the air tank inspection findings, including notations of damage, corrosion, oil contamination, and leaking, to the Resident Inspector for review and Hidden Damage repair or replacement consideration. The Contractor shall present air tank inspection procedures to the Authority for review and approval as part of the design review process.

The Contractor shall replace all air tank and air system drain valves/petcocks with new OEM components.

3.12.4 Towing Connector Access Box

The Contractor shall replace tow connector air fittings (per MBTA configuration), check valves, access door magnetic catches and strikers, and the tow connector door hinge with new OEM components.

The contractor shall install a front electrical tow connector similar to the installation on the Authority's newer fleets utilizing existing vehicle harness. The connector shall be weatherproof, and all electrical connections appropriately shielded from moisture and corrosion. The Contractor shall submit their proposed modification to the Authority as part of the design review process. [DRS #11]

3.13 Electrical System

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. [DRS #12]

3.13.1 Battery System (Low Voltage)

The Contractor shall replace the low voltage batteries with four new Type 31 AGM Glass Mat, 1150 CCA. Odyssey or approved equal batteries with positive and negative terminals of different sizes. Battery manufacturing dates must be within 3 months of bus shipment dates. The Contractor shall apply new temperature sensor strips, per New Flyer specifications to the top of each battery.

The Contractor shall clean, inspect, and test the equalizer. The Contractor shall prepare and conduct a test procedure to verify the equalizer is operating according to OEM specifications. All connections/terminals shall be cleaned. If the equalizer deemed out of specification it shall be replaced under Hidden Damage.

All Battery System associated cabling and connections shall be cleaned and inspected. Any damaged components shall be brought to the attention of the Authority for Hidden Damage repair or replacement consideration.

3.13.2 Battery Trays

The Contractor shall replace all battery tray rollers, bearings, and associated hardware. The Contractor shall inspect, clean, and lube the battery tray latch mechanism. The Contractor shall also clean and inspect the battery tray, cover, and support pieces etc. Any damaged components shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

The Contractor shall provide a revised battery securement and hold down system designed in a more robust manner/material to prevent hold down breaking/damage. Proposed designs and must be presented to the Authority for approval as part of the design review process. All associated hardware is to be replaced with new.

3.13.3 Fuse Box

The Contractor shall inspect and clean all fuse box connections and battery disconnect switch; inspect cables and cable seals, jump start connector, clean and check the compartment lamp operation, and inspect and clean the door and seal assembly.

The Contractor shall refinish/repaint the fuse box door and replace door latches with new OEM stainless steel. The Contractor shall include in their torque procedure the torque values and torque verification methods for all cable connections inside the fuse box. [DRS #1]

Any fuse box component found to be defective shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

3.13.4 Charging System (Low Voltage)

The Low Voltage Charging system is comprised of numerous components including the APS-2 (Accessory Power System), battery equalizer, and batteries etc. addressed individually in previous sections. Buses have been recently retrofitted to include a New Flyer supplied battery management system which includes a voltage regulator, load shed relay and current sensor mounted in the engine compartment fuse box, and a temperature sensor mounted between the 12-volt batteries.

The Contractor shall provide a low voltage charging system test procedure designed to ensure the low voltage charging system functions as designed and is charging the 12-volt batteries at the required rate. The Contractor

shall include the test results documentation in the Coach History book.

3.13.5 Multiplex System

The Contractor is responsible for providing an updated Vansco program to accommodate the integration of the mirror turn signals. The Contractor shall be responsible for all aspects of the Vansco program changes and shall test and verify the updated Vansco program will not adversely affect any other bus system, operation or component. The Contractor shall provide three (3) electronic copies of the Vansco program, three (3) hardcopies of the updates (redlines) required to Vansco ladder logic, and a full vehicle Vansco function test procedure to the Authority for review as part of the design review process.

The Contractor shall clean and inspect all compartments containing Vansco modules and test all modules to confirm proper operation. All harnesses and connections shall be cleaned and inspected. The Contractor shall confirm proper routing of harnesses to avoid strain on the connections.

Any multiplex system component found to be defective shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

3.13.6 Exterior Lighting

The Contractor shall confirm proper functionality of all exterior lighting. The Contractor shall replace all side turn signal lamp assemblies. Any other LED lamps with any cracked, broken or missing lenses, as well as LED non-illuminated or missing segments, shall be considered non-working and presented to the Resident Inspector for Hidden Damage repair or replacement consideration.

The Contractor shall check headlamp high and low beam operation and adjust the headlight aiming in line with Massachusetts state inspection requirements.

3.13.7 Passenger Area Lighting

The Contractor shall clean and inspect all passenger interior lighting for proper operation. The Contractor shall replace all interior stepwell and upper deck step lamp assemblies with new LED lights.

Any non-working or damaged passenger area overhead lights or lenses shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

3.13.8 Automatic Passenger Counting (APC) System

The Contractor shall inspect and test all APC system equipment for proper operation. The Contractor shall provide a test procedure for the Authority's review as part of the design review process. APC system equipment that is non-functional or damaged shall be brought to the Resident Inspector for Hidden Damage repair consideration.

3.13.9 Video Surveillance System

The Contractor is not responsible for the operation or any modifications to the camera system. The Contractor shall take appropriate protective measures to ensure camera system components are not damaged, this includes removal and reinstallation if necessary.

3.13.10 Electrical System

The Contractor shall replace all relays, circuit breakers, and fuses located on the vehicle with new. All grounds (including studs, bolts, etc.) on the vehicle shall be cleaned, inspected, and reassembled and torqued using new hardware. Dielectric grease shall be applied to all ground hardware after reinstallation.

All terminals and connections in battery compartment, auxiliary electrical compartment, and engine compartment shall be cleaned, inspected, torqued, and coated with dielectric grease. Any other terminals blocks, studs,

electrical junctions, etc. shall be inspected and if requiring replacement, be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

All interior and exterior speakers shall be tested by the Contractor to verify proper functionality. Speakers found to be not functioning properly shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

3.13.11 Stop Request System

The Contractor shall test all passenger stop request tape switches, ADA touch pads, and stanchion switches for correct operation. All defective, damaged, or missing stop request switches shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

For any stop request switch required to be removed due to other work scope tasks (e.g. flooring replacement) proper removal and reinstallation is required. Stop request wiring shall not be cut to remove stanchions. The Contractor shall ensure reinstallation will include proper use of grommets and deburring of sharp edges to reduce potential for chafing.

3.13.12 Engine Compartment Lighting

The Contractor shall replace the three engine compartment lights with three new brighter LED lamp assemblies, Maxxima 820 Lumen lights or Authority approved equivalent. The Contractor shall propose lights and alternate locations during the design review process.

3.13.13 SDS (Radio) Box

The Contractor shall inspect all wiring harnesses and cables inside (including entry and exit from) the SDS box for chafing. The Contractor shall replace all SDS drawer locking and non-locking slides with new OEM *locking* drawer slides. The Contractor shall check the operation of the SDS box compartment light and clean the interior of the SDS box. Drawer slides shall be installed to eliminate component and wire harness interference when deploying shelves. The Contractor shall ensure all SDS compartment wiring is appropriately dressed to prevent pinching, chafing, tight bend radius of harnesses, etc., and allows for the complete extension of all shelves.

The current SDS drawer retention bar mount bracket and retaining clips are loose and damaged. The Contractor shall provide a revised SDS drawer retention bar and mount bracket system designed in a more robust manner/material to prevent mount bracket and clip failure.

The Contractor shall provide to the Authority an SDS compartment inspection and repair procedure, and a revised SDS drawer retention system as part of the design review process.

3.14 HVAC System

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. **[DRS #13]**

3.14.1 Thermo King HVAC System

The HVAC system shall be overhauled, inspected, and tested in line with Thermo King recommendations. The Contractor is responsible for working with Thermo King to develop an appropriate system overhaul procedure and scope designed to ensure optimum system performance and reliability is maintained over the remaining life of the bus. All persons working on the HVAC system must be trained on high voltage safety procedures, have the appropriate refrigerant system license, and be trained and certified by Thermo King on the RLF system.

The Contractor's ThermoKing HVAC system overhaul procedures shall include:

- Initial testing of the HVAC system and controls functionality to verify proper operation and system refrigerant pressures before performing the HVAC overhaul to include:
 - Static system and operating high and low side pressure readings
 - Controls testing shall include verification of proper IntelligAIRE III control operation and perform the following IntelligAIRE III tests:
 - Relay test, evaporator fan test, condenser fan test, perform functional test
 - Verification of proper floor heater module operation
 - Testing and verification of proper driver's display panel and control operation
- Refrigerant evacuation
- Cleaning of Thermo King HVAC unit covers, panels, insulation, ducts
- Replacement of all components noted below
- Recharge HVAC system with virgin refrigerant
- Post HVAC system overhaul test shall include a retest of all items described in the initial testing of the HVAC system above. The post HVAC system overhaul test shall verify all overhaul tasks have been performed and the HVAC system functions in line with OEM specifications.

The Contractor shall provide written test procedures incorporating the basic requirements above and shall include post HVAC system overhaul test reports in the Coach History Book. Defects noted on the initial HVAC system test shall be presented to the Resident Inspector by the Contractor for review and potential Hidden Damage repair or replacement consideration.

The Contractor's overhaul of the Thermo King HVAC system shall include the replacement of all components identified in TS Attachment 5, and shall also include the following:

- Four (4) condenser motor/fan assemblies
- Streetside and curbside evaporator motor assemblies
- Return air filter and shockcord of the latest OEM revision (see below for details)
- Dehydrator
- Relief valve and O-ring
- All four (4) temperature sensors
- Suction and pressure transducers
- Switch high pressure cutout
- Boost pump relay
- Refrigerant
- Add compressor harness clips

The Contractor's overhaul of the HVAC system shall also include the following tasks:

- The current ceiling mounted air return doors are sagging. The Contractor shall provide a retrofit procedure, bill of materials, and relevant drawings for adding a third lock assembly to the air return door as part of the design review process.
- Thermo King has made advances in return air filter design. The Contractor shall replace the return air filter and shockcord with the latest recommended OEM Thermo King filter and shockcord.
- The Contractor's HVAC system overhaul shall include the replacement of all bus to heater water hoses in the SDS compartment with new OEM New Flyer hoses and hose clamps. The Contractor's procedure to ensure coolant/water from the heater hoses does not leak onto components in the SDS box shall be included in their HVAC system overhaul procedure.
- The Contractor shall replace all underfloor, convector system, and HVAC unit flexible coolant hoses and

hose clamps

- The Contractor shall install compressor wire harness clips
- The Contractor shall clean power supply and ground studs on Thermo King control panel

The Contractor shall provide a complete Thermo King HVAC unit overhaul work procedure, initial and post system overhaul test procedures, air return door retrofit documentation, updated return air filter documentation, bill of materials, safety procedures, employee certifications and licenses, and all other component updates documentation to the Authority for review and approval as part of the design review process.

3.14.2 Driver's Heater/Defroster

The Contractor shall replace the driver's heater/defroster complete assembly (including the replacement of the blower motor unit, rectifier, relays, filter, water control valve, and all internal and bus to heater/defroster unit hoses and clamps etc.) with new OEM, and test the defroster fan control, air recirculation, and temperature control switches at each setting. The Contractor shall ensure the new assembly is properly sealed to all ducts. Contractor shall also test and confirm the proper operation of the driver's floor heat and vent.

The Contractor shall notify the Resident Inspector of any component that does not meet full operational OEM requirements, for Hidden Damage repair or replacement consideration.

3.14.3 Floor and Convector Heaters

The Contractor shall test and confirm the proper operation and functionality of the curbside floor heater and streetside convector assembly. The Contractor shall replace the convector coolant solenoid valve and all floor heat and convector system coolant supply and return hoses and clamps with new OEM. The Contractor shall reseal all floor holes around all coolant holes and pipes after replacement of coolant supply and return floor and convector heater hoses. The Contractor shall clean the heater cores and coils, convector, housings, grates, and meshes. The Contractor shall replace all filters with new.

The Contractor shall notify the Resident Inspector for any defective or broken components for Hidden Damage repair or replacement consideration.

3.14.4 Auxiliary Coolant Heater

The Contractor shall replace the auxiliary coolant heater assembly with a new Spheros unit in line with New Flyer specifications.

Components to be replaced by the Contractor with new OEM components shall include but are not limited to:

- Intake and exhaust pipes, clamps, and blankets
- All hoses, lines, fittings, valves, and hardware
- Fuel housing assembly, and fuel lines (replace with appropriate stainless-steel braided lines which comply with all industry standards)
- Auxiliary heater fuel filter
- Electrical and sensor components

The Contractor shall test the auxiliary coolant heater coolant shut-off valves. Non-functional valves shall be presented to the Resident Inspector for Hidden Damage replacement consideration.

3.14.5 Booster Pump Assembly

The Contractor shall replace the booster pump assembly in its entirety, including the motor and pump assembly and all related hardware and spacers with new OEM. The Contractor shall also replace all associated coolant hoses and hose clamps in the booster pump/heat system/auxiliary heat system coolant circuits.

3.15 Structures & Chassis

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. This submittal shall include a Corrosion Protection Plan as described below and further in TS Attachment 3.

3.15.1 Structural Repairs

The Contractor shall inspect the structure of all buses in line with the Serial Production Structural Inspection Procedure. The Contractor shall perform all repairs according to OEM and standard acceptable industry practices. All structural repair methods, including AWS welding procedures must be presented to the Authority for review and approval prior to implementation on any bus. **[DRS #14]**

Areas where more than twenty-five (25) percent of the original material thickness is removed by corrosion reduces the structural integrity of the component. When this is determined by use of an ultrasonic thickness tester, (to measure metal thickness compared to the original component thickness) these parts are to be either reinforced or replaced with a new component. If there is visible surface corrosion, it is to be removed, and the metal treated with a rust inhibitor to prevent further corrosion.

Structural damage (cracks, poor welds, excessive corrosion) uncovered in the course of remanufacturing the bus shall be presented to the Resident Inspector by the Contractor for Hidden Damage repair consideration.

All structural repairs shall be performed by the Contractor following OEM procedures to maintain OEM warranty.

3.15.2 Corrosion Protection / Undercoating

The Contractor shall thoroughly pressure wash and clean the understructure (with all belly pans removed), engine compartment, and attic compartment and perform a detailed inspection. Care should be taken when pressure washing around the horn and back up alarms to prevent damage. Horns and back up alarms found to be weak or non-functioning after pressure washing will be the responsibility of the Contractor. Exposed hoses, tubes, and wires shall be covered and/or protected during the cleaning process.

New Flyer has developed an Instruction to Service (ITS 6607) for preventative maintenance and reapplication of a comprehensive corrosion preventative system for a MBTA 60-foot bus (TS Attachment 3 provided for reference purposes only).

The Contractor will be responsible for developing a procedure that maintains New Flyer structural corrosion warranties and appropriately addresses the underbody, chassis, and component corrosion and prevents further deterioration of the bus structure. The procedures shall be presented to the Authority for review and approval during the design review process. **[DRS #15]**

At a minimum, the corrosion protection/undercoating procedure should include the following:

- Removal of road debris/grime
- Underbody corrosion removal and treatment
- Underbody and internal tube salt eliminator application
- Internal tube rust inhibitor application
- Reapplication of zinc primer (where applicable)
- Complete undercoating application of the bus underbody and engine compartment frame

3.16 Interior

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. **[DRS #16]**

3.16.1 Interior Cleaning

The Contractor is responsible for the thorough cleaning of the bus, including interior panels, ceiling panels/headliner, SDS (radio) box, flooring, equipment locker, driver's locker, take one racks, destination sign compartment, ventilation ducts and liners. The entire interior must be thoroughly cleaned of graffiti, stains, minor scratches, chewing gum, etc. Cleaning shall be completed just prior to shipment of the bus to the Authority and reviewed by the Authority's resident inspector as part of the final walk and release for shipment process.

3.16.2 Panels and Applied Parts

The Contractor shall inspect all side panels, ceiling panels/headliner, ventilation ducts and liners, equipment box, SDS box, and Driver's locker. The Contractor shall replace all latches, locks, and hinges of the equipment box and driver's locker with new. The Contractor shall replace all corroded, damaged, missing, and or loose interior fasteners with new stainless-steel hardware. Missing or damaged interior side panels, trim, ceiling panels/headliners, and headers shall be presented to the Resident Inspector for Hidden Damage repair or replacement consideration.

The Contractor shall use "Anti-squeak" tape between interior trim panels and any structure. All components approved for replacement shall meet OEM material, fit, and finish specifications.

3.16.3 Doors

The current rear electronic equipment access door locking latches are not adequate and are prone to releasing in service. The Contractor shall replace all rear electronic access door latches with a new redesigned lock/latch mechanism. New locking mechanisms shall be submitted to the Authority by the Contractor for approval during the design review process.

The Contractor shall replace all ACTM/drive unit access door latches, hinge and seal with new OEM. The new latches and hinge shall be stainless steel. The Contractor shall inspect the support prop rod and notify the Resident Inspector of any defects for Hidden damage repair or replacement consideration.

All other access doors and panels, including latches and hinges, shall be inspected. Any damage found shall be presented to the Resident Inspector by the Contractor for Hidden Damage repair or replacement consideration.

3.16.4 Interior Paint

The Contractor shall refinish and paint the curb and street side front wheel tubs, SDS (radio) box, front dash panels, driver's overhead panel, farebox pedestal vertical transition, equipment box, driver's locker, and any other panels forward of the ADA seating area. The Contractor shall paint all interior modesty panels. All interior paint shall match and maintain the same color, gloss, longevity, and anti-vandalism characteristics of the original finished surfaces.

The Contractor shall powder coat the front dash grab rails, as well as all entrance and exit door handles with an Authority approved color.

The Contractor shall ensure any ceiling and/or side wall panels approved for repair or replacement shall meet OEM material, fit, and finish specifications.

The Contractor shall provide paint and powder coat samples and documentation of requirements conformance to the Authority through the design review process for review and approval prior to the painting of the Pilot Vehicle. [CDR #13]

3.16.5 Sub-Floor Repairs

Sub-floor areas that are identified as needing significant repair/rework shall be presented to the Resident Inspector by the Contractor for Hidden Damage repair or replacement consideration. Replacement sub-floor sections shall be plywood nominal 3/4-inch, seven (7) ply thick AB marine grade plywood installed with the A side up and with all edges sealed. The APA markings or certification must be visible from the underside of the bus before undercoating is applied. Floor panels shall be comprised of pieces as large as possible with joints located only over structural members. No transverse joints shall be used in the entrance and exit ways. All exposed edges of the floor panels, including openings for ducts and conduits, and joints between panels, shall be waterproofed and sealed prior to installation.

Corrosion resistant fasteners and appropriate adhesive (approved by the Authority) shall be used to retain the floor and all floor fasteners shall be serviceable from one side only. The flooring shall be mounted to the existing tapping plates. Any damaged flooring shall be repaired as per OEM specifications. Before applying the floor covering, all voids, fastener heads, and cracks in floor panels surface shall be filled with a fire retardant, two-part epoxy, leveling compound, and the floor sanded smooth. The methodology and the type of adhesive used to bond the floor covering to the bus floor shall be as recommended by the manufacturer of the floor covering. All seams and edges of the floor covering shall be welded / sealed to prevent water from entering between floor and covering. The floor covering seams shall be a minimum of 8 inches from seams in the sub-floor material, unless specifically approved otherwise by the Authority.

3.16.6 Floor Covering Material

The Contractor shall replace all floor covering material with a similar color Gerfloor Tarabus Sirius material. The Contractor shall utilize where applicable Gerfloor complimentary products including *Stepbus* slip resistant nosing with an aluminum profile, and *Safebus* slip resistant covering on the wheelchair ramp top surface. The Contractor shall replace the yellow standee line with an Authority approved 6" wide yellow strip, replace all driver's compartment flooring, replace upper deck step floor material, and replace exterior nosing and extrusions. All extrusions shall be secured using stainless steel fasteners of the appropriate type and size. The Contractor shall remove all existing floor covering, clean all residual adhesive from the plywood subfloor, allow for appropriate drying, properly level the subfloor, and install new flooring per Gerfloor recommendations. The flooring material shall be installed in a way to minimize seams, waviness, and eliminate bubbles and lifting. The Contractor shall replace all floor trim, edge moldings, coves, corner trim, and securement hardware with new stainless steel.

The Contractor thoroughly clean and apply new anti-skid material to the top of the farebox pedestal. The Contractor paint the sides of the farebox pedestal black to match the driver's front dash panels.

The Contractor shall replace all driveshaft access door service latches with new OEM stainless steel latches and shall replace the driveshaft door floor covering with the approved Gerfloor. The installed driveshaft access door assembly, including latches must be flush with the surrounding floor to prevent a tripping hazard. The Contractor shall inspect the driveshaft shield and driveshaft access door and notify the Resident Inspector of any missing or damaged components for hidden damage repair or replacement consideration.

The Contractor shall be required to have all employees replacing and/or supervising the replacement of the floor covering material receive OEM Gerfloor flooring installation training.

The Contractor shall provide floor color choices, Gerfloor complimentary product options, Contractor's floor covering installation procedures, Gerfloor training attendee certifications, farebox pedestal anti-skid and paint proposal, and all associated documentation to the Authority as part of the design review process. [DRS # XX]

3.16.7 Interior Mirrors and Shades

The Contractor shall replace the driver's windshield and side window roller blinds with new OEM roller blind

assemblies.

The Contractor shall inspect all interior mirrors and notify the Resident Inspector of any missing, loose, or broken interior mirrors for Hidden Damage repair or replacement consideration.

3.16.8 Interior Decals and Placards

The Contractor shall install Seifert Graphics Inc. monograms, numbers and other special signage to the interior of the coach as specified in TS Attachment 2. The decals and placard configuration will be reviewed and approved during the Pilot Bus FAI. The Contractor should not install any decals on the Pilot Bus without the Authority's approval. A finalized decals and placard configuration shall be appropriately documented and submitted by the Contractor and approved by the Authority prior to delivery of the first serial production bus.

Paint must be allowed to properly outgas prior to the application of any decals or placards. Decal and placard installation processes shall be in line with recommended industry standards. [DRS #X]

3.16.9 Driver's Barrier

The Contractor shall refurbish the Driver's Barrier to 'like new' condition in accordance with OEM procedures. Basic work tasks shall include:

- Contractor shall replace all wear items including hinge bushings, rubber stops, and slide tracks
- Contractor shall inspect and adjust all Driver's Barrier components including latches and tethers
- Contractor shall replace all fixed and sliding glazing and retention hardware

The Contractor, while working with the Arow Global, will provide a proposal for a retrofit including materials and labor to install extended coverage glazing.

The Contractor shall inspect all other Driver's Barrier components and shall bring to the attention of the Resident Inspector any damaged or missing components for Hidden Damage replacement approval. Any Driver's Barriers identified as missing on Departure Inspection shall be replaced by the Contractor as Hidden Damage.

3.17 Exterior

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. [DRS #17]

3.17.1 Cosmetics and Body

The Contractor shall repair all dings, cracks, dents, and gouges on all bus exterior panels, compartment doors, roof side screens as basic work. The Contractor shall follow New Flyer, component and panel manufacturers recommended procedures for the repair, removal, and installation of all exterior panels, components, and compartment doors.

The Authority is transitioning from the use of advertising sign frames to advertisement decals. The Contractor shall remove all remaining sign frames. The Contractor shall propose a procedure for filling all sign frame mount holes in bus side panels, side impact panels, and compartment doors ensuring a permanent and non-visible repair, to the Authority for review as part of the design review process.

The Contractor shall repair all side impact panels including the patching of all advertisement sign mount and other holes. Body side impact panels that have damage beyond repair shall be brought to the attention of the Resident Inspector for Hidden Damage replacement consideration.

Any significant damage or severe cracking shall be presented to the Resident Inspector for Hidden Damage

repair or panel replacement consideration.

The Contractor shall provide external panel, component and compartment door 'body' repair procedures and materials to the Authority for review as part of the design review process.

3.17.2 Exterior Paint

The Contractor shall paint all exterior surfaces, including access doors, entrance and exit doors, impact panels, panels, rooftop side screens, and rooftop enclosure assemblies in line with the paint scheme included in TS Attachment 2. The MBTA has recently adopted a modified paint scheme for newer buses, where paint colors are applied contoured to the design of the front-end mask (reference TS Attachment 2 for an example). The Contractor will be responsible for applying this new contoured paint scheme to the front-end mask.

In preparation before painting, all painted exterior surfaces shall be sanded to a feathered edge, properly cleaned and primed with a compatible (and applicable material) self-etching PPG Delfleet Evolution F4921WH 2.1 VOC epoxy primer (and F4922 2.1 VOC epoxy hardener). Colored paint shall be applied using PPG Delfleet Evolution (FBCH) paint. Clear coat shall be applied using a compatible PPG Delfleet Evolution (FBCH) clear coat. The Contractor is responsible for verifying the correct primer, hardener, and additives with PPG for use on each surface being painted with Delfleet Evolution products.

The Contractor shall properly prep and paint all side impact panels with GREY - FBCH947527 and reinstall onto the vehicle. The Contractor shall be responsible for ensuring proper paint adhesion is maintained on all side impact panels.

Proper adhesion between the base surface and successive coats of the original paint shall be measured using a Cross Hatch Adhesion Test as outlined in ASTM D3359B. Adhesion testing must be completed by the Contractor on the Pilot Bus and every fifth bus thereafter with documentation included in the Coach History Book.

The Contractor shall apply all paint smoothly and evenly with the finished surface free of dirt, runs, orange peel, and other imperfections. The Contractor shall measure each vehicle for paint gloss per ASTM E1347-06. One paint gloss meter reading of each color shall be taken from each of the four sides of the of the bus. No paint gloss test point reading shall measure less than 85. A paint gloss procedure including testing locations shall be presented by the Contractor for the Authority's review and approval. The Contractor will be required to follow gloss meter testing procedures on each bus with results documented in each Coach History Book.

In the event roof top components are removed during the overhaul process, all roof areas otherwise obstructed by the removed roof components shall be painted by the Contractor before the components are re-installed. All re-installed roof components shall be properly sealed to prevent water intrusion. The Contractor shall take appropriate measures to avoid painting of latches, hinges, antennas, roof hatches, cables, hoses, pipes, and electrical components. The Contractor shall replace all roof anti-skid tape strips with new OEM material in the same locations as originally installed.

The Contractor shall prepare a paint coating and application document containing procedures for surface cleaning and preparation, priming, surfacing, and painting for the bus body, interior components, and all equipment that is painted or powder coated. A detailed paint schedule showing the equipment painted, paint type and manufacturers, recommended thickness, and other pertinent information shall also be included. This document shall be submitted for review by the Contractor at the initial design review meeting.

Any equipment or parts of equipment which would be damaged or suffer impaired operation from painting shall not be painted and shall be corrosion resistant. Excluding original manufacturer painting, the following items shall not be painted:

- A) Wire and cable
- B) Heat transfer surfaces
- C) Electrical insulators
- D) Elastomeric portions of air and refrigerant lines
- E) Grounding pads
- F) Elastomeric parts
- G) Grease fittings
- H) Linkages
- I) Threaded parts used for adjustments
- J) Electrical equipment
- K) Wearing surfaces

The Standard paint colors and clear coat to be applied are listed in the table below.

MBTA White	FBCH947577
Yellow	FBCH947578
Black	FBCH947526
Blue	FBCH947724
Gray	FBCH947527
High Build Clear	F3906 (Evolution)
White (Roof)	Durabak 18UV

Three sets of spray out cards of each paint color shall be provided to the Authority by the Contractor for review and approval prior to the painting of the Pilot Vehicle. [CDR #13]

3.17.3 Front and Rear Bumpers

The Contractor shall remove from the bus and clean the front bumper assembly on all buses. The Contractor shall install new isolator strips between the bumpers and chassis bumper mounts/brackets to prevent corrosion. The Contractor shall remove all front bumper mount/bracket corrosion and apply a corrosion resistant coating and paint prior to reinstallation. All hardware/fasteners shall be replaced with new.

The Contractor shall replace the complete rear bumper assembly including the bumper structure and all modules with new OEM. The Contractor shall clean the bus chassis rear bumper mount surfaces, remove any corrosion, apply a corrosion resistant finish, install new isolator strips, and install the new rear bumper assembly with new hardware.

All damaged front bumpers and mounts/brackets shall be presented to the Resident Inspector by the Contractor for Hidden Damage repair or replacement consideration.

3.17.4 Mud Flap Assembly

The Contractor shall replace all mud flap and splash guard assemblies with new 3/8-inch minimum thickness rubberized fabric. Mud flap and splash guards shall be installed in the original locations and shall extend downward to within three (3) inches of the road surface and shall be of the original dimensional configuration. Mud flap assemblies shall be bolted to the bus understructure using original mounting locations and a suitable backing plate configuration utilizing new stainless-steel retainer brackets and appropriately sized stainless-steel hardware/fasteners.

The Contractor shall replace all static straps with new utilizing new stainless-steel hardware.

The Contractor shall submit all mud flap and splash guard assemblies, retainer brackets, and static straps to the Authority for review and approval as part of the design review process.

3.17.5 Skid Plates and Underfloor Enclosures (Belly Pans)

The Contractor shall replace the curbside skid plate with new and using new stainless-steel mounting hardware. The welded streetside skid plate shall be inspected and any damage presented to the Resident Inspector by the Contractor for Hidden Damage repair consideration.

The Contractor shall remove all underfloor enclosures and inspect (or replace as required) all protected equipment, wiring, hoses, valves, etc. The Contractor shall repair minor bends and dents in all underfloor enclosure panels and reinstall with new seals and all hardware with new stainless-steel fasteners. The Contractor shall notify the Resident Inspector of any missing or severely damaged underfloor enclosures or any unforeseen defects, for Hidden Damage repair or replacement consideration.

3.17.6 Exterior Mirrors

The Contractor shall be responsible for replacing all exterior mirror assemblies with new mirror assemblies containing integrated turn signals. The Contractor shall also be responsible for installing wiring, modifying/updating Vansco Multiplex System logic, and reprogramming systems to allow the use of the mirror integrated turn signals in all buses.

The Contractor shall submit a work plan including a full bill of materials, work and test procedure, and Vansco program to the Authority for review and approval as part of the design review process. The Contractor is responsible for ensuring the updated Vansco Multiplex program is correct for this application and does not adversely affect any other bus system.

3.17.7 Windshield Wipers and Washer

The Contractor shall replace both complete windshield wiper motor and wiper/arm/blade assemblies with new OEM components. Components to be replaced include but are not limited to street side and curbside wiper motor complete assemblies (including baseplate assembly, idler and motor crank shafts, bushings, spacers, etc.), wiper arms and blades, spacers, idlers, hardware, etc. The Contractor shall also replace the windshield wiper operator control switch and control knob with new OEM. The Contractor shall confirm proper adjustment and operation of the windshield wiper system.

The Contractor shall replace all windshield washer pumps and filler cap assemblies. The Contractor shall inspect the windshield washer bottle assembly, hoses, and fittings for leaks and/or damage and fill the bottle with the appropriate windshield washer solvent/antifreeze. The Contractor shall bring any defects to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration. The Contractor shall check and confirm proper operation of the windshield washer system.

3.17.8 Bike Rack System

The Contractor shall refurbish the existing bike rack assembly, including the replacement of any hardware, springs, release/locking mechanisms, and other wearable components.

The Contractor shall remove bike rack mounts attached to the bumper frame, address corrosion, and powder coated prior to reinstallation. Mounting hardware shall be replaced with new stainless-steel. Damaged mounts or bike rack components not mentioned above shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration.

3.17.9 Roof

The Contractor shall clean and reseal all roof panel seams/joints to a watertight condition. Roof panels shall be inspected for damage and proper securement. The Contractor is responsible to remove and reinstall all rooftop equipment as appropriate in order to appropriately address the roof seam repairs. The Contractor shall supply to the Authority a roof seam inspection and repair procedure for review during the design review process.

The Contractor shall clean, inspect, and reseal all roof mounted antennas, fasteners and harnesses/cables penetrating the roof skin to prevent any water intrusion.

The Contractor shall inspect all roof emergency exit hatches for leaking, damage, and proper operation. Any roof hatch exhibiting defects shall be brought to the attention of the Resident Inspector for Hidden Damage repair or replacement consideration. The Contractor shall be required to follow New Flyer ITS-6180 in the event a roof hatch replacement, removal, or if re-sealing is required.

The Contractor shall verify the integrity of the roof. The roof shall be inspected and confirmed to be intact and leak-proof. Any damage to the roof (except as specifically noted), including leaks, roof tears, impact damage, broken fasteners, etc. shall be presented to the Resident Inspector for Hidden Damage repair consideration.

The Contractor shall re-seal the top and bottom of the rain gutter to the bus body.

3.17.10 Roof Side Screens

New Flyer issued ITS-6246 due to the cracking of roof side screen brackets with a couple buses having been retrofitted by the Authority. The Contractor shall be responsible for inspecting the condition of all roof shrouds, side screens (skirts), mount brackets, and cable mounts on all buses. The Contractor shall be responsible for procuring all materials and performing all tasks identified in New Flyer ITS-6246 on all buses.

The Contractor shall repair all side screen panel damage and refinish/paint.

The Contractor shall notify the Resident Inspector of any non-repairable side screen panels, additional side screen bracket failures, or cable mount failures for Hidden Damage repair or replacement consideration.

3.17.11 Decals and Signage

The Contractor shall install Seifert Graphics Inc. monograms, numbers and other special signage to the interior and exterior of the bus as specified in TS Attachment 2. The decals and placard configuration will be reviewed and approved during the Pilot Bus FAI. The Contractor should not install any decals on the Pilot Bus without the Authority's approval. A finalized decals and placard configuration shall be appropriately documented and submitted by the Contractor and approved by the Authority prior to delivery of the first serial production bus.

Paint must be allowed to properly outgas prior to the application of any decals or placards. Decal and placard installation processes shall be in line with recommended industry standards. [DRS #111]

3.18 Windows and Windshields

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. [DRS #18]

The Contractor shall inspect all glazing, window frames and seals, and vandal shields for damage including scratches, cuts, graffiti, etc. Any damaged or missing window glazing, frames, seals or vandal shields shall be presented to the Resident Inspector by the Contractor for Hidden Damage repair or replacement consideration.

The Contractor shall replace all window emergency release handles and inspect and lubricate all "Emergency Push Out" window latches and cables. The Contractor shall confirm operation and functionality of windows in line with OEM recommendations. Any damaged or non-functioning latches, hinges, or cables shall be brought to the attention of the Resident Inspector by the Contractor for Hidden Damage repair or replacement consideration.

The Contractor shall retrofit all transom window set screw locks with AROW square keyed locks. All transom and emergency push out window bulb seals shall be cleaned and appropriately lubricated to prevent sticking.

The Contractor shall check the operation of all transom window pistons and condition of seals and report any defects to the Resident Inspector for repair or replacement Hidden damage consideration.

The Contractor shall replace the driver's window latch, felt seal, and glass vertical weather-stripping.

The Contractor shall test and confirm there is no water intrusion at any window.

The Contractor shall thoroughly clean the interior and exterior surfaces of all windows.

3.19 Access Doors & Panels

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. [DRS #19]

3.19.1 Exterior Doors and Panels

The Contractor shall replace all access door and access panel parts including but not limited to: prop rods, safety stops, chains, handles /pockets, latches, locks, gas cylinders, bumpers, seals and hardware with new. All removable hinges (hinges not bonded with an adhesive to a compartment door) shall be replaced with new stainless-steel hinges. The Contractor shall adjust all doors and latches in line with OEM fit and finish requirements and procedures. The Contractor shall inspect all hinges that are bonded with an adhesive to a compartment door and notify the Resident Inspector of any defects for Hidden damage repair or replacement consideration.

The front street side underbody steering box and steering shaft access panels are displaying excessive rust/corrosion. The Contractor shall provide a work procedure, bill of materials, and related drawings for the replacement of the steering box and steering shaft access panels with stainless-steel for the Authority's review and approval as part of the design review process. The Contractor shall include the replacement of all hinges, locks, and fasteners with new stainless-steel in their design review submittal.

The Contractor shall replace the fuel access door and hinge assembly with new OEM.

The Contractor shall replace all roof mounted equipment access door and panel latches, hinges, cylinders (door pistons), and using new stainless-steel hardware.

The Contractor shall inspect, straighten and secure all access door and panel screens and grills using OEM methods.

The Contractor shall rework all access doors and access panels as required to straighten, remove dents, repair cracks, and repair intake/exhaust screens, etc. The Contractors rework procedure shall include the removal of any corrosion from any access door or access panel and their subcomponents. If access doors or panels require significant rework, they shall be presented to the Resident Inspector by the Contractor for Hidden Damage repair or replacement consideration.

3.20 Entrance & Exit Doors

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. [DRS #20]

The Contractor shall refurbish all passenger entrance and exit doors to an "as new" condition. All existing door panels shall be removed from the bus, bead blasted or sanded, refurbished, repainted, and reinstalled.

The Contractor shall replace all door seals, brushes, and covers on all entrance and exit doors. All emergency, door controller assembly, and door dump valves shall be replaced with new OEM. The Contractor shall rebuild

front and rear door motors/base plate assemblies with new components to OEM specifications including all solenoids and mag valves, door motors, bearings, bearing blocks, connecting rod assemblies, electrical control and pressure switches and all associated hardware. The Contractor shall replace all door shaft bushings, bearings, pivot plates and mountings; and all sensitive edges components, including wave switches, nylon tubing, and sensitive edges with new OEM components. The Contractor shall also replace all doorway perimeter seals and door glazing seals with new OEM. All base plate and door system mounting hardware shall be replaced with new stainless-steel hardware.

The Contractor shall inspect and check all door shafts for straightness and powder coat before re-installation. If a door shaft is identified as requiring replacement it shall be brought to the attention of the Resident Inspector by the Contractor for Hidden Damage replacement consideration.

Door shaft covers are to be cleaned and inspected.

The Contractor shall powder coat the entrance and exit door handles to match the existing color.

3.21 Passenger Seating & Stanchions

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. [DRS #21]

The Contractor shall thoroughly clean each seat. Scuffs, chips, scratches and graffiti in the gel coat shall be repaired and/or buffed out by the Contractor. The cleaning and repair method / procedure shall be submitted to the Authority for review.

Passenger seats and mounting track shall be cleaned and inspected to verify they are securely attached at the sidewall. The Contractor shall tighten and adjust loose seating hardware as required. Any seat rail attachments or seat panels which are missing cracked or otherwise broken shall be presented to the Resident Inspector by the Contractor for Hidden Damage repair or replacement consideration.

The Contractor shall test all ADA flip seats for proper operation and verify that they lock in both the “up” and “down” positions. ADA folding seats have experienced cracking near the hinge, the Contractor shall inspect for cracks. The Contractor shall check verify the operation of the ADA seat mounted stop request switch and check for any missing or damaged ADA seat components. The Contractor shall notify the Resident Inspector of any defects for Hidden Damage repair or replacement consideration.

In addition, the Contractor shall replace the following interior features with new OEM:

- All passenger-assist straps
- All stanchion cup gaskets, including those mounted on modesty panels and windscreens
- Middle and rear door windscreens, and all associated mounting brackets/hardware
- All ADA and wheelchair securement components, including tie-downs, belts, and hardware

The Contractor is responsible for addressing any loose seating hardware and stanchions, and any seating and/or stanchion alignment issues.

The Contractor shall remove all staining/rust from stanchions and mounting cups/brackets. All upper and lower deck seat stanchion cups and clamps shall be removed, bead blasted, and powder coated. All upper and lower deck stanchion cup gaskets shall be replaced with new. All broken stanchion cups shall be presented to the Resident Inspector for Hidden Damage replacement consideration. The Contractor shall ensure the correct stainless-steel stanchion hardware is properly reinstalled to eliminate any sharp edges.

3.22 Destination Signs and Other Out of Scope Equipment

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. [DRS #22]

The Contractor shall protect front, rear and side destination signs from incidental damage. The Contractor shall thoroughly clean the interior of the front and side destination sign compartments and sign glass. The Contractor shall ensure all destination signs removed from buses are properly labeled and re-installed into the correct buses.

The Contractor shall provide a procedure to ensure all equipment not to be replaced, overhauled, and/or refurbished is protected. Proper storage and disassembly techniques should be included as appropriate.

3.23 Driver's Area

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. [DRS #23]

3.23.1 Driver's Controls

The Contractor shall test and verify the functionality of all driver's components including but not limited to controls, gauges, indicators, illumination on the instrument panel assembly, side console switch panel, and all other driver's area controls (including those located in the front destination sign compartment).

The Contractor shall repair any non-functional or dim driver's side console lighting.

The Contractor shall replace all drivers side compartment captive screws and inserts with new.

The Contractor shall replace all driver's foot control plate assembly stainless-steel screws and t-nuts with new.

The Contractor shall replace all headlight high/low beam, hoodlum alarm, left and right directional, covert alarm, and floor mounted microphone switches with new OEM.

The Contractor shall replace all accelerator and brake pedal assemblies including covers, baseplates, rollers, sensors, air valves, and associated hardware with new in line with OEM specifications.

The Contractor shall replace all five position door controller assemblies, complete including the selector lever, with new OEM.

Replacement of any component/system not previously noted shall be brought to the attention of the Resident Inspector by the Contractor for Hidden Damage repair or replacement consideration.

3.23.2 Driver's Seat

The Contractor shall install a new Driver's seat, Recaro ERGO Metro AM80 equipped with an occupancy sensor, new operator's seat belt assembly and all new hardware.

The Contractor shall confirm proper operation of the new seat air controls and occupancy sensor. Any seat determined to be in good condition by the Resident Inspector or noted as such on the Departure Inspection shall be protected and returned to the Authority by the Contractor.

3.24 Wheelchair Ramp

The following work scope, part numbers, and applicable work procedures will be submitted by Contractor and reviewed by Authority as part of the design review process. [DRS #24]

The Contractor shall rebuild the wheelchair ramp assembly per OEM specification. At a minimum, the Contractor shall replace the following wheelchair ramp assembly components with new, shall include but not limited to:

- Mechanism assembly (including all chains, bearings, bushings, etc.)
- Anti-skid Ramp surface
- Hydraulic pump assembly and hoses
- Alarm
- Hinge
- Trim
- Pull-up strap
- Installation of a new composite subflooring for the ramp platform
- Floor covering
- All hardware (including shims as needed)
- Anti-skid, where appropriate
- All edge trim pieces with new stainless-steel hardware
- Harnesses/ wiring and connectors

The Contractor is responsible for the proper fitment, adjustment, testing and operation of the wheelchair ramp assembly installation. The Contractor shall submit the work and test procedure for the Authority's review and approval as part of the design review process.

3.25 Optional Work Scope

The following optional work scope, part numbers, and applicable work procedures (if executed) will be submitted by Contractor and reviewed by Authority as part of the design review process. **[DRS #28]**

3.25.1 Option 1 – Additional Corrosion Protection Applications

The Contractor shall provide two (2) additional corrosion protection applications at 24-month intervals, with the first reapplication scheduled 24 months following each bus acceptance at the authority after being overhauled and the second reapplication 24 months after the first reapplication. The Contractor will be required to perform undercoating reapplication at a location not on MBTA property.

New Flyer has developed an Instruction to Service (ITS 6607) for preventative maintenance and reapplication of a comprehensive corrosion preventative system for a MBTA 60-foot bus (TS Attachment 3 provided for reference purposes only).

The Contractor will be responsible for developing a procedure that maintains New Flyer structural corrosion warranties and appropriately addresses follow up inspection, cleaning, and reapplication of Corrosion preventatives/inhibitors to prevent further deterioration of the bus body and structure. (also reference Section 3.15.2) An "inspection / undercoating reapplication" procedure shall be presented to the Authority by the Contractor for review as part of their Technical Proposal submission. If awarded, final review and approval by the Authority of the Contractor's "inspection/undercoating reapplication" procedure shall occur during the design review process.

3.25.2 Option 2 – Engine (Cummins) Extended Warranty

The Contractor shall provide an OEM extended warranty on all Cummins ISB 6.7 diesel engines. The Authority requires the extended warranty proposals terms be for a total of five (5) years and 200,000 miles from the acceptance of the vehicle. The warranty shall provide for service from MBTA's local Cummins Factory Authorized dealers.

3.25.3 Option 3 – License Plate Recognition (LPR) System Installation

The Contractor shall install and integrate a new license plate Recognition (LPR) system capable of operating on the Authority's existing security/camera system and infrastructure. The Contractor is responsible for all costs associated with software and hardware updates/modifications required to the Authority's existing system.

The Contractor shall reference TS Attachment 4 for work scope and requirements for the new License Plate Recognition (LPR) system installation.

3.25.4 Option 4 – New Destination Signs

The Contractor shall install and integrate the latest Luminator Smart Series III destination sign solution. This includes materials procurement; and installation of new front, curbside, and rear destination signs and all related subcomponents including cables and harnesses. The Contractor is responsible for all costs associated with software and hardware updates/modifications.

If awarded, final review and approval by the Authority of the Contractor's Luminator sign retrofit shall occur during the design review process.

3.25.5 Option 5 – Plug-in Hybrid Retrofit

The Contractor shall install and integrate a plug-in hybrid solution. This includes materials procurement; and installation of new equipment and all related subcomponents including cables, harnesses, and connectors. The Contractor is responsible for all costs associated with software and hardware updates/modifications. The Contractor shall reference TS Attachment 6 for additional requirements.

If awarded, final review and approval by the Authority of the Contractor's plug-in hybrid retrofit shall occur during the design review process.

3.25.6 Option 6 – Overhaul of up to 156 Additional Buses

The Authority reserves the right to exercise an option to overhaul up to an additional one hundred fifty-six (156) Hybrid 40-foot buses of a similar configuration purchased in 2016-2017 in accordance with Technical Specification VE20-051. This option would be executed at the completion of overhaul of the 60 base hybrid buses in approximately 2022. A shortened design review process may be required as part of this option due to differences in bus design configuration and components.